AUGUST 1989

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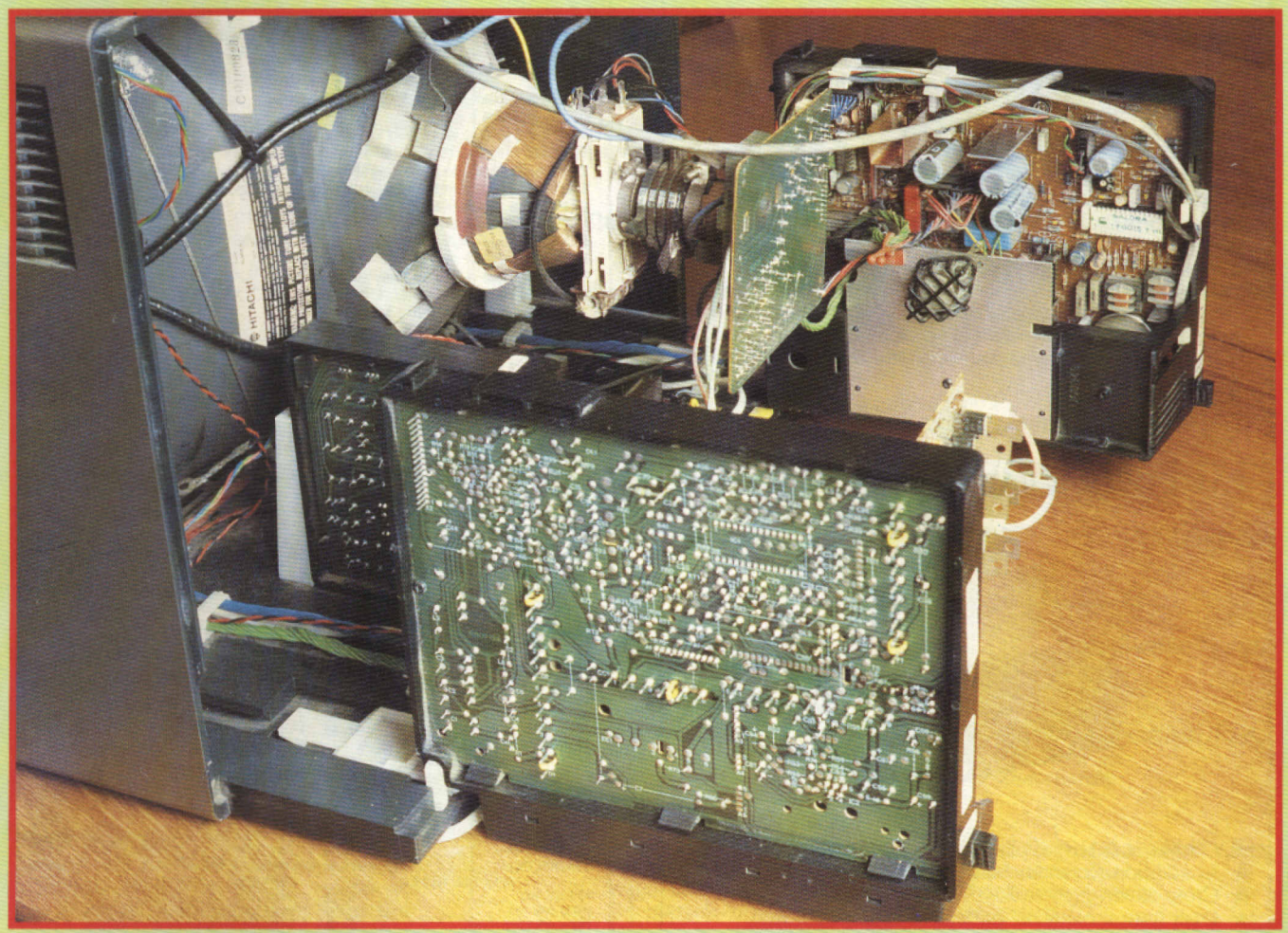
TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Servicing Salora Colour TVs
Satellite TV Servicing Aid
Computer Programmed RC Unit
Tatung's Early Bird Satellite Rx
TV Fault Finding • VCR Clinic
VHS System Developments
DX-TV • VCR Head Wear

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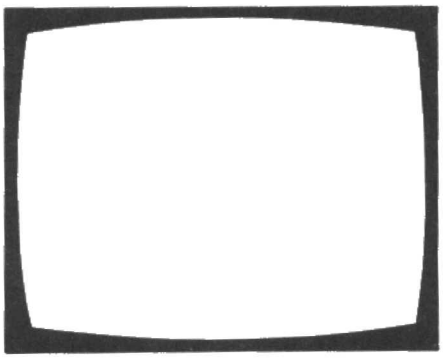

TELEVISION

August 1989

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CORRESPONDENCE

All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS.

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BACK NUMBERS

Subject to availability, copies of issues published during the last 12 months are available at £1·80 each from Television, Vouchcheck Services, Unit A6, Poplar Business Park, Prestons Road, London E14 9LR. Please make cheques/postal orders payable to IPC Magazines Ltd.

QUERIES

We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. Correspondents should enclose a stamped addressed envelope.
Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

741 Leader

742 Letters

747 Servicing Salora Colour Receivers, Part1 *Nick Beer and Ian Bowden*
This initial instalment deals with the F series chassis; including a detailed fault guide.

749 The Pretty Weightlifter *Les Lawry-Johns*
. . . and her Bush T22A. The sets are still playing their old tricks.

750 Review: Tatung's Early Bird *Eugene Trundle*
The Tatung satellite TV receiver system has an excellent outdoor assembly but some problems, not unique to Tatung, have been experienced with the indoor unit.

752 Teletopics
News, comment and developments.

754 VCR Clinic
Reports from Philip Blundell, Eng Tech., Nick Beer, Hugh Allison, Roger Burchett, Stephen A. Featherstone, Eugene Trundle and Joe Cieszynski.

756 Servicing Compact Disc Players, Part 6 *Joe Cieszynski*
An account of the techniques used to detect and conceal errors in the digital audio signal. Errors commonly occur due to minor pressing irregularities and surface blemishes.

760 Computer Programmed RC System *Eugene Trundle*
An account of the technology employed by the One-for-All remote handset, whose memory can be programmed with any required codes.

762 Video Head Life – an Investigation *Steve Beeching, T.Eng.*
The factors that affect head wear and the results of an investigation carried out by MCES using sophisticated Japanese equipment.

763 Next Month in Television

765 Satellite TV Servicing Aid *D. J. Stephenson, B.A., I.Eng.*
A unit that will provide the LNB and polariser supplies required by the Amstrad and Grundig head units, making the receiver independent of the outdoor system. D.C. isolation is incorporated in the signal path.

768 TV Fault Finding
Reports from Philip Blundell, Eng. Tech., Mike Adye, Alfred Damp, J. G. Grieve, Chris Avis, Hugh MacMullen, J. K. Potts and Nick Beer.

772 Long-distance Television *Roger Bunney*
Reports on DX conditions and reception and news from abroad. SpE and tropospheric propagation produced plenty of signals during May.

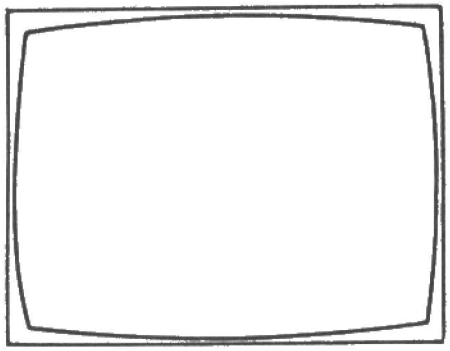
774 VHS System Developments *George Cole*
Panasonic and JVC revealed some significant prototype VCRs at the recent Chicago Consumer Electronics Show.

776 Small-screen Sets *Malcolm Burrell*
Small-screen TV sets are often regarded as being uneconomic to repair. As a result there are quite a few bargains about that have little wrong with them. Dealing with such sets can be a rewarding business.

777 Service Bureau

778 Test Case 320

OUR NEXT ISSUE DATED SEPTEMBER WILL BE PUBLISHED ON AUGUST 16



TELEVISION

EDITOR
John A. Reddihough

Please note that the telephone numbers below are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 729.

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CORRECTION
In the section headed tuning in last month's article on the Ferguson ICC5 chassis all references to the "IM bus" should have read "tuning bus".

COVER PHOTO
This month's cover photograph shows a set fitted with the Salora G chassis. See new series starting on page 747. The G chassis will be highlighted next month.

Games People Play

You might expect that someone who runs a business knows what he's doing. The founder obviously did, otherwise the enterprise would never have got off the ground. Whoever is in charge of day-to-day affairs usually does as well, otherwise he wouldn't be there for long. But matters are decidedly different when it comes to a firm's long-term strategy. One can be forgiven by the facts themselves for the somewhat cynical view that many, perhaps the majority, of boards have little idea of how the future will turn out, and that this is especially the case where management has been listening to the advice given by management consultants and the like. Why should anyone want to seek such advice? The busy management of a small company wouldn't of course. But the management, say third or fourth generation, of a very large company is often quite confused about long-term objectives. You think that I exaggerate perhaps? Well consider this. According to a recent Harvard Business School study, over half the takeovers made by a group of large US companies between 1950-80 had been sold off again by 1986. So what did they think they were doing in the first place?

The above bit of information comes from a very interesting article by Christopher Lorenz in a recent issue of the *Financial Times*. In it he surveyed many of the policies – fads he calls them – adopted by large US and UK companies in the post World War Two era. One of the most common, from the earliest part of the period and continuing right through to the present, has been the takeover to achieve diversification or, alternatively, sheer size in the market place. The takeover as a business strategy goes back much farther in time of course. But originally it had one of two prime purposes. Maybe to help a firm in financial difficulties, perhaps to secure the continued trading of an important customer, or of course to build market share the easy way. When the business consultants began to get into the act the reasons for takeovers became more sophisticated, for example to avoid the effects of cyclical trading on year-by-year profitability: the idea is that despite your trading in one sector being depressed, overall profitability can be maintained by more successful results in other sectors. Perhaps the most famous example of this strategy being taken to its extreme was ITT under Harold Geneen. The company's activities spanned, amongst other things, telecommunications, consumer electronics, insurance, hotels, food and car hire – none of them on a small scale either. The whole thing eventually became virtually unmanageable, and under Harold Geneen's successor large chunks were sold off. There is also the argument for conglomerates, as such firms are known, that they can achieve efficiency through operating as a sort of micro-economy. It seems that in the twenty years after 1960 the number of top US firms (the *Fortune* 500) that were diversified or conglomerates rose from 50 to 80 per cent. The equivalent UK figure rose from 40 to 60 per cent.

Although the arguments for diversification are plausible, and there have been firms that have managed to make a continued success of such an approach, by and large the approach has not worked well. Over the last five years or so the favoured policy amongst most large firms has been the exact opposite, what is known as the return to "core business activities". Concentrate on the firm's main business (if you can decide, in some cases, what that is) and sell off the rest. It's been a striking blow for the earlier fashionable views of many a business management guru that such an about turn should become so common. Interesting that Harvard's Theodore Levitt subsequently commented that "when it comes to implementing the ideas put forward I assume that the reader is someone of common sense and prudence". As Christopher Lorenz says, "that's quite an assumption".

Amongst other fashionable views of business policy that have been adopted in varying degrees over the last two-three decades have been to get out of "dog businesses", to "go for excellence", to adopt "matrix management" and to aim for "globalisation". Dog businesses are those that show low growth prospects. They became fashionable again when their usefulness in generating cash (they then became known as "cash cows") came to be appreciated. The idea of seeking excellence is to add to your company something that looks like having a bright future and will possibly create greater "value added", say to grab a bit of glamour by adding an electronics subsidiary. It didn't help that otherwise well managed firm Caparo Industries to buy Fidelity Radio with this in mind: Fidelity Radio was closed down about three years later.

One can't help but see the government's approach to broadcasting as another example of such fadism. Exactly what is going to be achieved by selling off the BBC/IBA transmitter networks when the present arrangements have proved to be highly successful and economical? Will the idea of replacing the IBA with the IBC and auctioning off the ITV franchises at the next review result in any genuine improvement in broadcasting, or will it merely represent the success of the try a new, fashionable approach for its own sake attitude over common sense? On balance it seems that the government's proposals will not achieve any benefits in terms of the quality of the TV services provided. The present arrangements have their shortcomings but work well. Will someone else in ten or twenty years decide that today's favoured policies have not been successful and should be reversed? With companies, such antics may not matter too much. But broadcasting is a public service, and the public has the right to assurance that it is not being messed about with for the sake of some fashionable notion. Unfortunately, that looks to be exactly what's happening.

Letters

ASTRA INSTALLATIONS

I feel that D.J. Stephenson's article on Astra installations (June) made matters sound somewhat over complicated. For example, while it's interesting to know the details for calculating azimuth and elevation angles it's not in practice necessary to do this. It's my experience, backed by that of our subcontractors and others in the profession, that installations can be carried out perfectly satisfactorily using a signal strength meter and possibly a compass. If the installer knows his area he/she won't normally require a compass. In addition if the receivers being installed have a tuning test point a signal strength meter is not required – though since the price of such devices has fallen considerably in recent months it's well worth having one.

It has been our local experience that dishes can be pointed in the right direction with minimal effort and, once loosely secured, can be aligned accurately and peaked up using either a signal strength meter or a DVM connected to the test point. The importance of spot-on alignment cannot be over-emphasised however: although a system may give perfectly acceptable results while you are there it will not, unless correctly aligned, continue to give good results in all weather conditions.

While an installation crew of two is obviously ideal, economic considerations mean that most installations are carried out by single individuals. An experienced person can do this perfectly satisfactorily, but again safety considerations cannot be over-stressed.

The approach outlined in the article would be much more relevant to polar mount/large dish systems where calculations can be required to get a starting point as well as for accurate alignment.

Pearce Heffernan's suggestions for dealing with noisy drum bearings in the Panasonic NV333/NV366 (Letters, June) are very useful. The only problem is that the NV333 tends to suffer from a sticky lower drum rabbet, thus necessitating drum replacement. The NV366 is not prone to this trouble but is very often the victim of noisy bearings, so Pearce Heffernan's notes will be particularly helpful here. Also, with its higher specification the trouble is more worthwhile with the NV366.

Nick Beer,
Bideford, N. Devon.

SATELLITE TV OBSOLESCENCE

Representatives of Sky Television and BSB say they do not consider that there is room for both systems and that only one will survive. I agree with this. Should Sky be the first to fold the Astra kits at present being sold by the High Street retailers could still be used for transmissions from Astra. But should BSB fold it seems likely that their dedicated encrypted D-MAC receivers/decoders will become obsolete, which would be a serious setback to the adoption of MAC as a future broadcasting standard. With this in view I would urge manufacturers of encrypted D-MAC decoders to ensure that they are compatible with uncrypted D- and D2-MAC transmissions, making the decoders much more flexible for future use and so avoiding the possibility of obsolescence.

The PAL system has served us well, but the technology is now over 25 years old. Anyone who has seen a demonstration of MAC with digital sound will appreciate the vast improvement. MAC with its digital package for expansion must be the European broadcast format for the twenty first century.

Brian D. Webb,
Havant, Hants.

BROOMSTICK METHOD

Why all this fuss about aligning satellite TV dishes for Astra? Our broomstick method works every time and has never let us down yet. Between 12·15 and 12·30 p.m. (BST) stick a broomstick in the ground and draw a line along the shadow. This line is the direction of the satellite. Point your dish along it and all you have to do is to rock the dish in elevation. The signal is so strong you cannot miss. Final tweaking for maximum signal is then all that's required. Who needs a compass etc.?!

D.G. Whitehead,
Dyffryn Ardudwy, Gwynedd.

PLAYING NTSC TAPES

John de Rivaz (Letters, June) asks about converting a PAL VHS machine to play NTSC tapes. Some time ago I obtained an American tape from a friend. I had one of the early Ferguson 3292 VCRs and on examining the circuit I found that the capstan servo is controlled by a 475Hz ceramic resonator. On removing this and fitting a 555 timer in its place I managed to get a locked monochrome picture and sound from the NTSC tape. Small adjustments to the drum servo might be needed and of course a TV set that will lock to a 60Hz frame signal is required.

D. Weston,
Bolton, Lancs.

DIFFICULTIES WITH SPARES

I would like to add a few comments to the letter from R.T. Blyth of Wizard Distributors (June). As one of the smaller dealers mentioned by Mr. Blyth, our problems with obtaining spares from manufacturers are becoming almost impossible. If Wizard have doors closed, we have them firmly slammed! What a good job we have people like Mr. Blyth to fall back on, but what a pity he cannot get the backing of all the manufacturers.

The setmakers don't really deserve to have spares/service people around to repair their products. There are a lot of us with knowledge and experience of the repair business but we can go only so far without co-operation from the makers. If they won't provide this, we'll have to start telling their customers what a shower they are! Keep up the good work Wizard, we all need you.

R.K. Shaw, Teignmouth TV and Lighting Centre,
Teignmouth, Devon.

MAINS LEAD WARNING

I was recently given for repair a Sony C7 that had been with another engineer for some months, allegedly waiting for spares. There were large black circular lines on the case and I was told that these had not been there before. The cause of this damage was the mains lead, which had been coiled up and left on top. As a result the silver paint had been eaten away, leaving the black plastic from the lead.

Several months ago I stored away my own turntable unit which was not being used. When I examined it I

found that the mains lead had stuck to the acrylic top. On removing the lead I discovered similar damage to that on the Sony VCR.

So here's a warning to others: don't rest mains leads on top of equipment with plastic cases if the equipment is to be stored for any length of time. Does anyone know why a PVC lead should attack plastic?

M. Bennett,
Romford, Essex.

RECORDING PROBLEMS

John de Rivaz (Letters, June) asks about modifying UK VCRs for playback of 525-line System M recordings. There was a very interesting letter from D. Plummer on this subject in the May 1983 issue, page 369. He'd successfully modified a Ferguson 3292 and a 3V23 for monochrome 525-line playback.

My sincere thanks to everyone who wrote to offer help and advice with my old Elizabethan LZ32 open-reel audio recorder. I'm pleased to be able to report that a salvaged Peto Scott transformer has brought it back to life – I'd been trying for many months without success to obtain a replacement. I was also given a couple of addresses of firms that provide rewinding services and pass these on in case they may be of use to others:

Majestic Transformer Co., 180 Windham Road, Bournemouth BH1 4QY. Telephone 0202 34 676.

Trans Tronic Ltd., Cobnar Wood Close, Chesterfield. Telephone 0246 260 044.

It's unfortunate that due to falling demand even many specialist shops no longer stock open-reel tape. Tandy however have a Radio Shack/Concertape "Budget General Purpose" brand at £2·99 for a 7in. 1,800 ft. spool. This is very good value and the sound quality isn't at all bad.

Brian Renforth,
Sandyford, Newcastle-upon-Tyne.

MOTOR TRADE GETS 'EM TOO

This little story has nothing to do with TV sets but may raise a smile amongst those of you who have to deal with the nuttier members of the public.

I have a good relationship with my local garage. They look after my trusty Morris and I look after the electronic equipment of most of the staff there. I also repair the odd car radio which is out of warranty. Recently a customer complained about the radio in his new Ford, his complaint being that when he switched the radio off the speakers on the rear shelf still produced faint audio – those in the doors were off. He brought the car in for investigation. Now we've had trouble with Ford branded radios before. The on/off switches have a mind of their own – so much so that in many cases we bypass the switch altogether so that the radio is controlled only by the ignition. Some owners seem to prefer it like that, which goes to show what a noisy life some people lead. But I digress . . .

We found that the door speakers were silent, but some audio was apparent when the engine was switched off and everyone else in the workshop was asked to stop the noisy things they were doing. It could have been annoying as one glided silently along – not a problem for me as the Morris may glide but is not silent . . . The odd thing was that the on/off switch appeared to be working – the light went out anyway. It was about now that we switched on the long wave and found Radio Four. When we switched off again the rear speakers continued as usual – with Radio One!

Opening the boot revealed all – a portable radio busily playing Radio One to itself. The car's owner had given some colleagues a lift home and all the tools etc. had gone into the boot, the radio remaining behind. The motor trade gets them as well you see!

Roger Burchett,
Hythe, Kent.

DEGAUSSING AID

Some weeks ago I discovered something that many people have found amusing. Remove the magnetic stator from an old Ferguson 3V35 capstan motor, slide it over a screwdriver blade, bring it near a magnetised c.r.t., spin it on the blade then withdraw it from the c.r.t. You'll find that it's almost as good at degaussing a magnetised tube as a Labgear coil! Being small it's easy to carry in a tool box – but keep it away from your test tapes.

Richard Flowerday, Harborne TV Services,
Harborne, Birmingham.

HELP WANTED

Could any of your readers help with the following desperately required items? (1) A circuit diagram for the Scopex GP DB1 oscilloscope. (2) A circuit diagram for the Matsui 2060 colour receiver, also a TA7698AP chip for this set.

Gordon Burdett, 2 Dawpool Drive,
Moreton, Wirral, Merseyside L46 0PH.
Telephone 051 677 8893.

Does any reader have a circuit diagram or any other information on the Mermaid Electronics 99-channel cable converter made by Policom, Milano, Italy?

Jens Hovedskou, Telstar Video Service,
Engparken 4, 6700 Esbjerg, DK Danmark.

MICROWAVE TV

Over the last couple of years you have published comments on the prospects for microwave terrestrial TV broadcasting, an option that has received official approval for use in Ireland. Readers may be interested to hear about the current situation here. Up to the end of April there has been no progress in starting TV transmissions in the 2·6GHz band. Some tests have been carried out from a hill near Waterford in the south east but were soon moved to a higher hill. The results are thought to have been disappointing. Taking into account the terrain in the south and west of Ireland this is not surprising. Band III RTE reception is not too good in many towns and villages, so the prospects for effective microwave coverage are poor.

The larger thirty-mile radius "cells" will be allowed to transmit at a power level of up to 32dBW per vision channel, i.e. about 1·6kW peak e.r.p. Thus with the envisaged eleven-channel system the total microwave power radiated from some sites would be over 20kW. Residents at locations near these projected transmitters, say up to a mile away, are concerned at the prospect of being bathed for 24 hours a day with amplitude-modulated microwave energy equivalent to over thirty domestic ovens at frequencies close to the potent 2·45GHz oven

frequencies. I know of no other situation where a civilian population would be subject to such microwave energy levels – and the operators will be really only testing the system.

With the limit of eleven channels, the Irish systems will rapidly fill their capacity – the third Irish channel, four and later five UK services, a possible Irish-language service, two film subscription channels and just two or three left over for satellite TV channels. The Astra channels are already available throughout the country, mostly at good quality using 60cm dishes.

The terrestrial microwave channels will be 8MHz wide with a.m. and will not be capable of being upgraded to HDTV or any other developments – after all the idea is over 25 years old – just plain old PAL a.m. at much higher and more difficult to receive frequencies. Many Continental countries are now considering the use of terrestrial microwave transmissions at 11/12GHz, compatible with existing domestic satellite TV receivers and with envisaged local coverage of 5-10km, unlike the proposed national coverage here. I think that the Irish authorities will have to consider the use of u.h.f. to fill in the areas not covered by the microwave transmitters. Commercial cable TV operators see microwave transmission as a quick, cheap way of reaching adjoining areas which would be uneconomical to serve by using conventional cabling along the roads. By using point-to-point microwave links from elevated sites they can cable the town areas of interest (and maximise profits) while leaving the rural areas to receive a virtually hit or miss TV service. The introduction of scrambling limits viewers to operation of their microcomputer controlled TV and video equipment at almost monitor level.

Irish viewers along the east coast and in the north midlands areas, with direct access to the UK as well as the Irish channels, are spoilt for choice, with simple equipment operation. The wiring associated with descrambler boxes linked to VCRs and TV sets found in cabled areas is enough to make strong men weep – especially after the little woman has tidied up the wiring to her liking!

I await with interest the extension of TV choice across this country: satellite or terrestrial microwave transmissions, time will tell.

Des Welsh,
Carrigaline, Co. Cork.

EHT LEAD PROBLEM

Here's an unusual "fault" I recently encountered on a 14in. Pye colour portable fitted with the Philips CTX chassis. The set, labelled "sound but no picture", was bought at a knock-down price from a local junk shop. A quick check in the shop revealed that the line output stage was working (as was to be expected since the sound was present!) and that the tube's heaters lit, but there appeared to be no e.h.t.

Back at home the rear cover was removed and the set was found to be in a heavily nicotine-stained state – except for a gleaming new e.h.t. cable assembly. Checks at the tube base showed that the voltages here were present and correct, including the focus and first anode voltages, while a neon screwdriver held near the line output transformer lit. Attention was therefore turned to the new e.h.t. lead. I eventually realised that the new lead couldn't be pushed far enough into the transformer to make contact with the e.h.t. source. Examination then revealed that the brass ferrule soldered to the end was of slightly larger diameter than the cable! Fitting a smaller one from a scrap lead solved the problem – when the lead was refitted it went about an inch farther into the transformer. The resulting picture was very good indeed.

So if you find that you have the no e.h.t. symptom after replacing the e.h.t. lead, check that it fits properly. You should of course obtain a lead approved by the manufacturer – these sets are BEAB approved. The original repairer probably assumed that the line output transformer had failed and had written the set off as being beyond economical repair.

S.T. Mott,
Moordown, Bournemouth.

TRIBUTES TO LES

It is with sadness that I read of Les Lawry-Johns' intention to hang up his boots. Having followed his articles for many years I feel as though I know him. I remember the good times, when his wry sense of humour and self-depreciation produced a lively and much needed alternative to the dry business of technology, at the same time giving those of us who are not geniuses confidence and reassurance through his intellectual honesty. I remember the more recent sad times when illness and technological pressure began to take their toll. But his most endearing qualities are his modesty and willingness to admit to mistakes – mistakes which we all make but are not too keen to publicise. I wish Les health and happiness in his retirement, and hope that we shall continue to hear from him in your pages. Well done Les.

Laurie Watkinson, Telesonic Services,
Holsworthy, Devon.

When my copy of *Television* arrived I followed my long-standing habit of checking the contents list to find out where the LLJ page was and was saddened by what I read. To find in a technical magazine articles that make you laugh aloud is unusual and shows that the writer has a rare talent. Do keep writing Les, you have no idea how much pleasure you have given all your regular army of readers over the years. Many thanks, and the best of luck to you.

L.J. Pitts, South Brent Electronics,
South Brent, Devon.

It's sad to read that Les is hanging up his soldering iron and going into retirement. We will miss the self-depreciatory style, hiding a vast experience of servicing and a lot of living. Being an ancient amongst readers, may I voice my appreciation of his marathon stint in contributing to the magazine?

In the sixties his circuits of current models and dissertations on their stock faults and peculiarities were an invaluable aid to servicemen. His contributions became broader in scope in later years, dealing with problems solved, the animosity of errant TVs, and casting a jaundiced eye on their owners – from tightwads to sexpots. The saga of Gravesend became more interesting than much of the old "pony" offered on TV. This was especially true of the pets, felix diagnosticus, and the boozy flying mousehounds. On the distaff side Les must be a lucky man with his minder H.B., who has been a support in his ups and downs of fortune. I wish them both many happy years in retirement.

William Harrison,
Windsor, Berks.

Servicing Salora Colour Receivers

Part 1: The F Chassis

Nick Beer and Ian Bowden

Many service engineers tend to be put off by Salora colour receivers, particularly if they don't see a lot of them. This is mainly because the chassis employ some rather unusual circuitry, particularly in the power supply and line output departments.

The earliest Salora sets that appeared in the UK were fitted with the C chassis. This is now obsolete but it has certain similarities with the F series. There are still large numbers of F series sets around as it was a popular rental set with the independents as well as the national chains. We'll start off then with the F series, which started to appear in the UK in about 1980. Since the tubes are by now beginning to show their age it's no longer worth spending a great deal of money on these sets.

The power supply and line timebase has a substantial component count, and quite a number of faults can occur in this area. The line output stage is of the thyristor type, with THP2 (17022) the line scan thyristor and THPX1 (17023) the flyback thyristor. A third thyristor THA2 (TIC106M) is concerned with regulation while the fourth of these devices, THA1 (TIC106M), acts as a trip. The chassis is mains isolated, with the line scan thyristor on the isolated side and the other three thyristors on the non-isolated side. A group of wound components (MA2/3/4) provides the main isolation barrier.

It's easy to tell which chassis type is fitted in a given set as the appropriate letter is contained in the Model number. Thus with the F chassis you will find Models 1F0, 1F1 etc. The complete F series is as follows:

1F0: Standard 26in. set with self-seek tuning and optional remote control.
1F1: As 1F0 but with remote control fitted.
1F3: Standard 22in. set with self-seek tuning and optional remote control.
1F6: As 1F3 but with remote control fitted.
1F4: 22in. set with remote control plus teletext/viewdata capability and built-in clock display.
1F8: As 1F4 but with 26in. tube.

The chassis is a vertical, hinge-back type with the mains input, speaker unit and tuning arranged on a separate block at the left-hand side. This block can be unclipped and pulled from the back for access. The PCB lacquer is red, which gives the chassis a distinctive appearance. It was used in only large-screen models which all have microcomputer controlled 16-channel tuning with green bar indication. A great number of subpanels are mounted around the main panel, making these sets ideal for field service. The panels all have alphanumeric reference numbers, the letters indicating the panel type while the numbers indicate the version. Panel prefix allocations are as follows:

STA	Mother board.
STPX	Commutating panel (line drive and flyback thyristor stages).
STL	Line sync/oscillator panel.
STPR	Start-up and regulator circuit panel.
STP	Line output panel.
STAR	Regulator panel (12V regulator plus beam current limiting and one or two other bits and pieces).
STW	Field timebase panel.
STX	Raster correction panel.
STY	RGB output panel.
STH	CRT base panel.
STF	Decoder panel.
STCN	Electronic tuning indication panel.
STEJ	Sound i.f. panel.
STCC	A.F.C. panel.
STD	I.F. panel.
STUA	Remote control amplifier panel.
STUL	Remote control transmitter panel.
STSS	Mains input and switch panel.
STMF	Mains transformer and fuse panel.
STEN	Audio output panel.
STS	Front control panel.
STC	Tuning and memory panel.
STTL	Connection panel (aerial socket etc.).

Tuning Problems

These sets were amongst the first to employ microcomputer controlled tuning. They suffered from a few teething troubles in this area but Salora introduced several modifications that put matters right – until about three years ago, when the sets started to do odd things like one programme dropping out – retuning itself somewhere in Band I, or a whole group of programmes (e.g. 1, 5, 9, 13) doing the same. A colleague used to insist on tuning each channel so that the fine-tune voltage at the junction of DCC1 cathode and CCC1 in the a.f.c. circuit was 4V. This had a degree of success, but the problem remained.

We set about trying to overcome these odd faults and think we've come up with a series of actions that help – certainly we've had no comebacks to date. The chips on the STC tuning/memory panel are all mounted in holders. The first thing to do is to remove them and clean all the pins thoroughly, back and front (we use the RS fibreglass pencil). Solder them straight into the panel, then clean all the plug and socket connections and ensure that they are a tight fit. Resolder both ends of RC36, CC19 and crystal CFC1 – one or more of these is usually dry-jointed. Replace the tantalum capacitors CC12 and CC13 with subminiature electrolytics (4·7μF, 35V) which are more reliable, also replace CC17 (470nF, 35V, another tantalum capacitor). Ensure that all the push-button contacts are sound and clean, then finally realign the a.f.c. coil LCC1 as per the manual.

These measures are for intermittent faults. Obviously there could be an intermittent fault in one of the chips. Replacement is the only sure cure in this case, but lately we've found that the faults haven't been in the chips.

Fault Guide

A set of LEDs on the mother board shows whether the main supply lines are present or not.

The following list provides a run-down of the problems we've had over the years.

(1) Intermittent failure to start. This can be caused by the flyback thyristor THPX1 going open-circuit intermittently. Replace to confirm.

(2) Set dead, 220V LED not alight. More than likely RA17 (2·2Ω) and RA79 (820Ω) will be open-circuit and DA70 (F099/2) short-circuit due to the line scan thyristor THP2 being short-circuit. After replacement, try with the tripler disconnected. If o.k., introduce tripler lead gradually in case the tripler was the original cause of the trouble, starting a chain reaction.

(3) Won't start, line oscillator not running. Check whether the 18V supply is present at the line sync/oscillator panel. If not RA3 (390Ω) will probably be found to be open-circuit. It's on the mother board beside the line oscillator panel.

(4) Won't start, line oscillator is running, 25V LED is alight but 220V LED is out and all others are dim or out. Suspect the tripler. Check by disconnection.

(5) Set trips with a loud thump. Check TPX2 (BC307A) on the commutating panel.

(6) Set trips. Usually caused by dry-joints on the commutating transformer MA3.

(7) 2AT mains fuses FEN1 and FEN2 blown. Usually caused by THA1 going short-circuit. This is generally a permanent condition but can be intermittent.

(8) Won't start, no 12V rail. TAR4 (BC237A)/TAR6 (TIP32A) on regulator panel short- or open-circuit.

(9) Set starts then shuts down again. Check whether the 6·8V zener diode DAR3 on the regulator panel is leaky.

(10) Set keeps dying after changing DA71 (22V zener diode) and RA79 (820Ω). Replace the 17022 line scan thyristor THP2. It's probably flashing over intermittently.

(11) Raster goes white then set trips. RAR11 (15kΩ) on the regulator panel open-circuit.

(12) No sound. Check for breaks in the print between the slider of the volume control and pin 12 of plug/socket S1 on the front panel.

(13) No sound. Check for a dry-joint on connector TL3.

(14) No sound. Check CEJ10 (1μF).

(15) No tuning indicator bar. Suspect ICCN2 (AY-3-8331) faulty.

(16) Tuning drift. Check the tantalum decoupling capacitors CC12/13 on the a.f.c. reference and discriminator lines. Fit 4·7μF electrolytic replacements – see suggested modifications earlier. See also (70) and (83).

(17) No colour. CF43 (10μF, 35V) suspect.

(18) No colour. Check whether TAR3 (BC237A) on the regulator panel is open-circuit.

(19) Intermittent, no or excessive colour. Carefully adjust the line hold control RTL2.

(20) No green. RY15 (22kΩ) open-circuit.

(21) No blue. RY22 (10kΩ) open-circuit.

(22) Excessive green. RY13 (12kΩ) open-circuit.

(23) Green flashing or grey-scale shift. DCN1 (1N4148) leaky.

(24) Over-bright picture of the wrong tint/hue. DY11 (6·8V zener diode) leaky.

(25) Over-bright picture that cuts off when the control is turned down. DA61 (12V zener diode) leaky.

(26) No vision (luminance or chrominance). CF22 (0·1μF) open-circuit.

(27) Raster just discernible but no sound or vision. DAR3 (6·8V zener diode) leaky.

(28) No tuning, only snow. TD1 (BF199) open-circuit.

(29) Field slip from cold. Check for condensation on tripler case.

(30) Won't start from cold. Check CPX8 (10μF).

(31) Hum (1kHz) on EE and PB sound on the VCR channel. Fit a 100μF capacitor with the positive lead to pin 1 of connector A6 and the negative lead to pin 5. This plug is at the bottom left-hand side of the chassis, feeding the audio stage.

(32) Inaccurate clock operation (Models 1F4/8). Suspect the back-up cell. These are now old and when new required 24 hours for a full charge. See also (72).

(33) Thyristor failure. To prevent repeated failure ensure that you use adequate heatsink compound and that it is of the traditional white type (Servisol/RS etc.) not the transparent type. Remove any traces of the transparent stuff. When fitting replacements don't over tighten the spring washer. If only one thyristor has failed and either of the above points have not been observed both line output stage thyristors should be replaced.

Check the following symptoms/causes that tend to occur after thyristor failure. Tuning won't memorise: DA70, DA71, CA80 and RA79. Excessive beam current and set trips: RA17 and LA6. LA6 burns up: check LA4. No picture: RA34 (fit 120kΩ) and RA23. Field collapse: RA21.

(34) Field bounce, particularly noticeable with VCR operation. Alter RA86 from 27kΩ to 10kΩ.

(35) Excessive e.h.t. Check DPR7 (1N4148), TPR2 (BC237A) and if necessary DPR5 and DPR6 (both 1N4148). These are all on the start-up and regulator panel.

(36) No picture, e.h.t. o.k. RA34 open-circuit. Use a 120kΩ or 150kΩ, 1W resistor, not 100kΩ.

(37) No vision. Suspect ICD1, TD1.

(38) Poor sound. Usually ICEE1 faulty.

(39) Field collapse. Check TW13 and TW14 (both type BD278) in the field output stage.

(40) Lack of height. Check TW6 (BC307B), TW7 (BC237B), TW11 (BFR40) and TW12 (BFR80) as necessary.

(41) Intermittent rolling. Try CW1, CW5, TW1 and remove RW3. See also (29), i.e. check for condensation on tripler and in corner of mother board.

(42) Trapezium distortion. Usually CW18.

(43) No go, possibly intermittent. Check THPX1, THP2, DPX1/2/3 and TPX4 (BC237A).

(44) No colour. Usually ICF2 or XTF1.

(45) Intermittent colour. ICF2, CF14, CF3, RF22, XTF1 and ICF2's holder are known culprits.

(46) No picture. ICF1, TF1, CF22 or RF18.

(47) Low or varying contrast. ICF1, CF22 or CF4.

(48) Low, varying or excessive brightness. ICF1, ICF3, RTF3 noisy.

(49) Blue or green raster. ICF3.

(50) Low chrominance. CF38.

(51) No luminance, chroma o.k. DLF1 open-circuit.

(52) No field flyback blanking. TF2, ICF3.

(53) Hanover blinds. ICF3.

(54) Excessive brightness. Suspect DY11.

(55) Background RGB levels vary. Suspect presets on the RGB output panel.

(56) Intermittent red/green/blue. Check TY1/2/3 for red, TY4/5/6 for green, TY7/8/9 for blue.

(57) No line drive. Check TL8 (BC237A), TL9 (MPSA55) and DL10 (6·2V zener diode).

(58) Low drive causing intermittent starting. Check DL5 (TIL209).

(59) Poor sync. Check RL5, TL5, and DL2.

(60) Line speed high. Check CL12, DL3 and DL4.

(61) No remote control operation. ICC5, ICC6 or ICC7.

(62) Sticks on one channel. ICC5, ICC6 or ICC7.
(63) Won't memorise a station. ICC5, ICC6, DC8, TC5 and CC21 have all caused this fault.
(64) Scans tuning but doesn't stop when station found. CC12, CC13, CC18, RC31, TC1, TC2, TC3, RC35. Clean the contacts of the plugs and sockets on the microcomputer panel.
(65) Set won't sweep tune. ICC2, ICC3, ICC1 and CC17.
(66) Set runs but no control operation, no display of channel number etc. ICC1 or if accompanied by a tick on sound check the smoothing of the 15V rail (CC1, 470μF). This should be checked whenever a segment display fault is noted (see below).
(67) Display doesn't alter, e.g. stuck on no. 1. ICC1 and check for hum on 15V rail – see (66).
(68) Segment display goes out intermittently. ICC2 and check 15V rail for hum.
(69) Green bar tuning display does not disappear from screen. ICC2 and TC4.
(70) Tuning drift. ICC3, CC12, CC13. See also (16) and (83).
(71) No control operation for a few minutes from cold. Ensure that TC9 is type BC307B not BC307A.
(72) Clock runs slow (1F4/8). ICC1 and ensure that RC7 is 1kΩ not 2·7kΩ.
(73) No sweep tuning, display blank. ICC3, ICC6.
(74) No u.h.f. indicator. ICC7.
(75) One row of keyboard not working. Check continuity and replace keyboard as necessary.
(76) One segment in channel display not illuminated. DS1.
(77) Remote control not working, handset o.k. Check adjustment of RTUA1 (see below) or suspect ICUA1 or CUA2 incorrectly fitted.
(78) Remote control range poor. CUA8 not earthed or check adjustment of RTUA1 (see below).
(79) Set intermittently starts from standby on its own. Faulty self-wiping contact.
(80) Tuning display incorrect. ICCN2 or short out DCN2.
(81) No display. ICCN2.
(82) Display always on screen. ICCN1.
(83) Tuning drift. Add a 2·7MΩ resistor between pins 6 and 9 and an 8·2MΩ resistor between pins 3 and 9 of ICC3. Remove the 10MΩ resistor from pin 6. Also check the 33V regulator ICC4. Add a 1N4148 diode from the 33V rail to (cathode) pin 11 of ICC3, cutting the print to connect the diode in series. See also (16) and (70).
(84) Set intermittently shows an erroneous channel display. Replace CC4 and CC5 (previously 82pF) with 100pF or add 20pF in parallel with each. If the fault persists replace ICC3.

To adjust RTUA1 (remote control receiver) transmit from the handset and find the ends of the range of adjustment of RTUA1 where the IR receiver LED (on the channel display LED) lights, then adjust it for the centre of this range.

The Pretty Weightlifter

Les Lawry-Johns

I was sitting here minding my own business when a car drew up outside. A pair of pretty legs swung out, and a delightful young lady walked into the shop.

"Will you fix my TV for me?" she asked.

"Of course my dear, what name is it?"

"Wade" she replied. Wade? I'd grown up with these people, known them all my life. As I was writing this down she went back out front and opened the car's boot. I thought it would be a portable. She leaned over, and we saw more of the pretty legs. She then lifted out a 22in. Bush T22A. I've seen substantial men falter when lifting one of these out of a boot. She trotted in however and placed it on the bench.

"How did you manage that?" I asked in awe.

"No trouble" she smiled, "how much will it cost?"

"Not more than fifteen pounds" I said, resisting the temptation to say I'd do it for nothing.

"O.k. then, when shall I call for it?"

"This afternoon, please."

The T22A's Problem

So off she went. What a swinger! I took the back off and switched on. The power was present but nothing started. After disconnecting the tripler I tried again. Still nothing, but this time I heard the timebase start up and the sound began to hiss. I switched off and checked 5R13 (330Ω), over on the front right side at the bottom, in the tripler's earth connection. It was open-circuit, killed by the tripler. I fitted a replacement and removed the faulty tripler. In doing so the focus unit broke up. I shouldn't be so rough. With patience I installed a universal tripler, cut the leads to size and fitted a new focus unit. The set now worked well, displaying a good picture.

The young lady returned as promised and paid by cheque. This time I insisted on carrying the set out and putting it in the boot.

"Thank you, it nearly killed me bringing it in" she said.

"Anything for you, but don't do it again" I smiled. I was going to continue but Honey Bunch had by now taken an interest in what was going on and I had to behave myself.

A Tripping Thorn 8800

The next one in was a Thorn 8800 which really showed how stupid I've become. It was tripping, so I removed the e.h.t. rectifier's lead from the line output transformer. The thing then started up. Being the oaf that I am, I fitted a new e.h.t. unit and tried once more. After a delay the tripping started. Instead of disconnecting the focus unit I concluded that the e.h.t. rectifier I'd fitted was faulty. I fitted another one and this time smoke came from the focus unit then the tripping started again.

Fed up with myself by now I removed the focus unit and saw that there was a dent in its back. I searched high and low for another but couldn't find one – all the stuff is in sacks ready for the move, so I could have missed one. There was nothing for it but to nip along to Geoff's in Sun Lane. He was able to help out but with the new one fitted we still had tripping. To cut a long story short, the faulty focus unit had destroyed the e.h.t. units I'd fitted. I shouted at the cat and pushed her off the bench, then started the search for another e.h.t. unit. At last I found one and, with my fingers crossed, fitted it. Three had been destroyed but this time everything came on o.k. and I breathed a sigh of relief.

Honey Bunch appeared and commented that I always get the easy jobs . . .

Thanks

I'd like to thank all of you who've written. But don't come down to see me – I'm ashamed of the shop, the way I've let it go. Unless you want to buy it of course! I'd also like to thank Rick Kinslow for bringing in that bottle of 100 Pipers scotch. H.B. doesn't like it, so I had to drink it all myself. It was lovely and has lifted the depression that's been engulfing me lately, try as I might to throw it off. But I know there are a lot more out there worse off than I, so I mustn't moan.

Review: Tatung's Early Bird

Eugene Trundle

Quite a wide range of satellite TV receiving systems have become available since Astra was launched. Many are aimed at the volume market with prices in the under £300 region. A typical example is the Tatung Early Bird Model TRX1801, which has a suggested retail price of £250-£329 depending on the choice of dish size and LNB rating. I installed one at home and have lived with it for many weeks. We are also deeply involved in selling, installing and servicing these packages and sorting out any problems that arise. Thus this review takes a look at all aspects of the system.

General Description

A wall-mounted offset aluminium dish finished in white is supplied in either size 60cm or 80cm. The LNBs have HEMPT devices, the noise rating being 1·5 or 1·8dB to order. The receiver has IR remote control, with 19-channel selection from a small, simple handset whose ten keys are duplicated on the receiver's front panel, along with ± tuning buttons and a memory key. Station tuning and polarisation data are held in a non-volatile memory which is preprogrammed at the factory to the Astra channels for easy dish installation. A 1½-digit seven-segment red LED display provides channel identification (1-19).

Audio capability is single-channel (6·5MHz), i.e. mono only. The audio and video signals are modulated on to a u.h.f. carrier preset to ch. 38 but tunable over chs. 32-39. There's also a scart output connector providing mono sound in/out, MAC/PAL and baseband outputs. The u.h.f. input socket provides a loop-through facility. Other connections, at the rear, are for the LNB downlead (F connector) and the polariser supply. The receiver's main electrical characteristics are as follows: input 950-1,750MHz; threshold 6·5dB; power consumption 20W. It's a compact unit, measuring 250mm wide, 170mm deep and 63mm high, with a black plastic case.

Outdoor Unit

I believe that the dish assembly is one of the best in the budget range. The dish itself is elliptical and is mounted on a very heavy and sturdy wall bracket made of tubular steel. Its tilt and pan actions are positive, making alignment easy. Once these are set the clamping action is strong and rigid with virtually no "twang".

The LNB and feedhorn are mounted on a single, rigid tubular steel arm that sets the focus point without any need for adjustment. The magnetic polariser is incorporated in the feedhorn and is supplied by a separate twin-core cable which takes a constant bidirectional current of about 35mA. Its insertion loss is very low at around 0·3dB. The combination of this polariser design and the LNB pickup probe gives excellent polar isolation – exceeding 18dB for the Astra channels.

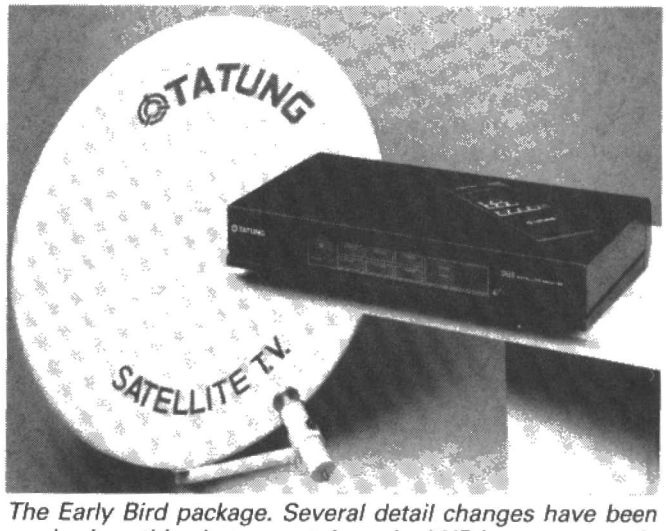
The LNB typically beats its noise rating by up to 0·2dB. Feedhorn and LNB are well protected from the weather and creepy-crawlies. I tried both the 1·5 and 1·8dB noise versions at different times with 60cm dishes and got good results from both at this part of the country within the 52dBW footprint.

All in all the design of the external unit is excellent, both physically and electronically. If properly installed it should be capable of standing up to the worst of the increasingly freakish British weather.

Indoor Unit

The indoor receiver, which is literally a black box, is capable of giving excellent pictures and passable sound, though in this price range the facilities are necessarily limited. The mono sound is fine so long as you don't intend to hook up to a stereo TV or hi-fi system, but there's no facility for reception of extra carriers (i.e. radio, alternate language or stereo) unless and until scart-linked add-ons become available. I found that the reproduced pictures are very good via either the r.f. or AV links, the exception being some very early production models whose energy-dispersal clamping was not fully effective, giving rise to vertical judder effects with some VCRs and TV sets. There's a modification available for those receivers that left the factory without it being done.

The receiver is easy to program. At the end of each



The Early Bird package. Several detail changes have been made since this photo was taken: the LNB is now square in cross-section and has a feedhorn; the front panel has ten numerical keys with ± tuning and memory buttons; and the handset is smaller and simpler.

sweep the channel-search system "flips" the polariser so that any channel can be assigned to any key – a useful feature for the user. The channel indicator is rather deeply recessed, obscuring it at large viewing angles, though the viewer generally knows what he's watching! I didn't like the rear polariser terminals whose design, construction and positioning seem to have been contrived for maximum inconvenience and hassle, even though the aerial riggers favour (and asked for) screw-type terminals. Fortunately no harm can come from short-circuits because the maximum current is limited to 35mA.

While on the subject of the polariser current feed, an excellent feature of this design is the pair of semi-accessible presets for fine adjustment of the horizontal and vertical polarisation skew. The best way to set these up is to reverse the polariser wires and adjust for *minimum* signal, then restore the correct connections.

The receiver runs very warm indeed, the heat sources being the mains transformer, the tuner/i.f. module and the stabiliser chip heatsinks. It's quite safe however, and while reliability is never helped by heat at least the high internal temperature remains constant if the unit is left permanently on, as intended – this is better than subjecting the internal components to heat-cycling. Even so the high cabinet temperature is rather disconcerting and has lead to a number of customer enquiries.

Remote Control Problem

Early versions of the receiver used the same remote control chip set as the Tatung terrestrial TV receiver range, so that both receivers would respond to the keys on either handset. This rather curious situation was resolved during production by changing to a different chip pair. We find that some makes of VCR and TV receiver respond to the commands of the new chips, so we keep the original i.c.s in stock too. This situation is by no means unique to Tatung, but in this case there is at least a chance to remedy the problem.

IF Radiation

Like many similar satellite TV receivers this one uses an i.f. of 479·5MHz, a standard agreed by BREMA. This has turned out to be an unfortunate choice since it falls within the u.h.f. broadcast band – in ch. 22 to be exact. Apparently this spot was picked to avoid mutual interference with mobile radio systems. I've not heard of a single case of mobile radio interference, but we've been driven up the wall by radiation from these satellite TV tuners getting into TV sets at or on about ch. 22, which happens to be one of our locals.

The basic cause of the problem is breakthrough, via the braid of the TV set's aerial cable, of radiation from the satellite receiver's i.f./demodulator block. BREMA maintains that as long as the satellite receiver meets the requirements of BS905 (radiation level of less than 700μV/m at 3m distance) there shouldn't be any trouble. In reality interference is rife. SAW filters for use at this frequency are lossy and have to be driven hard: in addition to this, the vision detector PLL uses an oscillator that runs at the same frequency. Thus massive screening is required to suppress these two sources of radiation. Good screening and careful manufacture can offer an improvement of perhaps 20dB, but in many circumstances such as weak terrestrial signal reception, the use of set-top aerials and close proximity of satellite receivers to cables this may not be adequate.

There are several possible alternative intermediate frequencies, for example 402, 610 and 612MHz. The latter two lie at about ch. 38, which conjures up horrifying prospects. Certainly 402MHz seems to be the best choice and in troublesome cases we are at present fitting an alternative tuner/i.f./demodulator module that uses this i.f. It's supplied by Tatung and completely solves the problem.

I gather that this i.f. radiation problem is not limited to Tatung receivers. Apparently Alba and Ferguson units can give trouble though the Amstrad design, which uses the same i.f., seems to be immune. All would appear to depend on the design of the module, PCB layout and "physicals". I'm told that 1992 will bring with it a requirement for UK equipment to conform to the much more stringent standards now maintained in some parts of W. Europe.

Reliability

The first batches of receivers were not, it has to be said, distinguished by their reliability. This was largely due to the hectic speed at which design and manufacture had to proceed. In this respect later production is much better: various modifications have been incorporated to improve performance and reliability.

Conclusions

As an engineer I'm impressed by the outdoor unit but less so by the indoor receiver. The fact that there is no service manual available as I write, three months after the receiver's release, is a minus point too. There are several good features of the design however, and it's easy to understand and to service.

As a viewer I'm happy with the picture performance and the unit's small, unobtrusive appearance, though I wouldn't have chosen it if I was specially interested in sound! It remains to be seen whether I'll be handicapped by its nineteen-channel capacity when all the Astra plans have been implemented and two or three satellites sit together at 19·2°E. Much depends I suppose on the languages that will be used for the various channels and the encryption situation. Certainly the family is thrilled by the idea of satellite TV channels. We've become enthusiastic viewers: the prospect of motor racing live from the USA at 11 p.m. is an attractive one for me, and my seven-year-old son feels the same way about the Children's Channel.

MAC and PAL

I've an open mind about the "who needs MAC?" controversy. From the quality point of view, provided the original material is good the PAL pictures from Astra are excellent. In 1967 I thought that the performance of the first colour TV sets was superb and virtually impossible to improve upon. Time has proved me wrong. In the same way MAC-derived pictures, when we get them early next year, could make the present ones look poor by comparison. Certainly the argument that PAL is not the best system to use with f.m. vision transmission has been borne out by our experience of satellite TV: highly-saturated colours are the first to suffer under borderline conditions.

Teletopics

SATELLITE SCENE

British Satellite Broadcasting has been awarded the remaining two official UK DBS channels by the IBA. When BSB's satellite TV service starts next spring it should thus consist of a total of five channels. BSB proposes to use the two extra channels for Now, an information channel, and The Power Station, a pop music channel. The other three channels will be used for a subscription movie service, an entertainment channel and a sports channel. News will be provided on all five channels. The IBA has asked BSB to make every effort to accommodate a substantial amount of children's programmes from Starstream, one of the unsuccessful applicants, in one of its channels.

The IBA has also told BSB that it is prepared to agree to a test programme to assess the quality of five-channel reception from BSB's initial satellite. This could lead to a temporary relaxation of the IBA's transmitter power specification. The original plan envisaged the use of two high-power satellites for the five channels. BSB's first satellite is due to be launched this month, with launch of the second satellite scheduled for summer 1990.

SES has announced that the second Astra satellite, 1B, will be launched in October 1990, a year earlier than originally planned. As with the current Astra 1A there will be 16 channels and the orbital position will be the same. Thames Television has taken an option on two of the Astra 1B channels. It proposes to move to satellite broadcasting should it lose its terrestrial TV franchise at the next review in 1991.

The BBC has signed a five-year agreement for eight hours a day use of one of the Olympus satellite's channels. Transmissions would be from 5 p.m. to 1 a.m. CET and would consist of material from BBC-1 and -2 plus educational and training programmes and maybe specialist subscription services. The aim would be to reach a European audience either via cable networks or individual dishes. Olympus is owned by the European Space Agency.

FERGUSON REORGANISES

Manufacturing activities are to cease at Ferguson's Enfield headquarters, with the loss of some 750 jobs by the end of the year. The company's commercial, R and D, engineering, finance and other central operations will remain at Enfield.

The main manufacturing activity at Enfield in recent times has been on subassemblies – remote control systems, teletext decoders and so on – with CTV manufacture centred at Ferguson's Gosport plant. All manufacturing operations will in future be carried out at Gosport, where the labour force is expected to increase by some 400 to about 1,300. Ferguson at present manufactures around 600,000-700,000 sets a year. The sluggish market, failure of the satellite TV market to take off and the loss of a manufacturing subcontract with JVC a couple of years ago are given as the main reasons for the retrenchment.

TRANSMITTER SELL OFF

The report by accountants Price, Waterhouse on privatising the radio/TV transmitter networks in the UK has been received by the Home Office and the Department of Trade and Industry and is being considered by ministers. It recommends that the BBC and IBA networks are split up and operated by two companies, giving each a national spread of transmitter sites. The two companies would offer services to the BBC and the independent radio and TV companies. Sale of the networks is expected to raise some £200m. The BBC's World Service transmitters would remain in the public sector.

The Government white paper on the future of broadcasting had suggested a regional basis for a privatised transmitting service. This could have made the provision of transmission facilities in remote areas very expensive. Instead, Price, Waterhouse have recommended that the networks are split up on a checkerboard basis.

BUSINESS MOVES

The Nokia Group is reorganising its consumer electronics operations in the UK. In a move aimed at securing future growth, Nokia Consumer Products (UK) Ltd. is being created, with headquarters at Swindon, and will commence trading on September 1st. The move will bring Nokia's major brands ITT-Nokia, Salora and Luxor together under common management.

SEME Ltd. has been appointed an official spares distributor for Panasonic. HRS Electronics plc is to take over distribution and spares supply for the Telefunken range.

Omega Electronics has moved to new premises at 304 Crown House, North Circular Road, London NW10 7PN, telephone no. 01-965 5748.

Visions London (formerly Bi-Tech of Leyton) has moved to Unit 4, Rainstar Industrial Estate, Eley Estate, Nobel Road, Edmonton, London N18 0AA.

NICAM ADAPTOR KIT

Audio-Visual Technical Support of Shelson House, 67A Shelson Avenue, Feltham, Middlesex TW13 4QS (01-890 3010/3004) has announced a Nicam 728 retrofit kit which the company says can be used to convert a wide range of TV sets and VCRs for reception of Nicam stereo transmissions. Cost of the kit is £68 plus VAT. It comes with kit for fixing plus leads and fitting instructions for certain sets. The brief specification is as follows: auto switching mono/stereo/bilingual; sensitivity 70μV with a parallel i.f. strip, 120μV with an intercarrier sound system; reverts to normal audio when Nicam is not present; optional four times oversampling.

Has Sky Television made a grave mistake asks Keith Cummins who took this photograph while on holiday recently at Noss Mayo in South Devon.

The company also has a self-contained Nicam 728 stereo TV tuner with remote control.

The IBA's first regular Nicam transmissions start next month (September) in the areas served by the Crystal Palace and Emley Moor transmitters. By the end of 1990 stereo digital sound should be available in all ITV areas.

VIDEO NEWS

Mitsubishi is to launch a Super-VHS-C camcorder in the UK this September. Model HS-C40B has been designed and developed by the company. It uses a standard size 62mm head drum which Mitsubishi says reduces jitter. Features include twin digital tracking for clean still frame and frame advance; VHS address search; interval recording and a self timer; a two-page title function; and three fast-shutter speeds. The HS-C40B has an auto white-balance system with a memory store containing 1,024 different light conditions, and incorporates Mitsubishi's CDRI (colour dynamic range improvement) circuit which is claimed to eliminate colour bleaching. The suggested price will be £1,400.

Panasonic is launching a VHS-C camcorder, Model NV-MC30B, with hi-fi VHS sound at £999. It has a 320,000 pixel image sensor with a minimum illumination of 10 lux; new auto focus, auto iris and auto white balance systems; insert edit, audio dub, synchro edit and camera search. There are also date/time recording and an optional titler.

JVC has announced two S-VHS compatible TV sets, Models CS2180 at £330 and CS2131 at £380. These 21in. sets are designed to take full advantage of the S-VHS system.

Syntronix Systems of St. Matthews House, Brick Row, Darley Abbey, Derby DE3 1DQ (0332 553 024) has introduced an S-VHS/scart RGB interface that eliminates the need to purchase a special TV set with S-VHS input facilities. S-VHS signals can be viewed via the interface which is connected to a set's scart socket. No internal modifications are required and the firm offers free advice on suitability. Price of the interface unit is £79·95 plus post and packing.

Methods of recording PCM digital stereo sound on VHS tape along with hi-fi f.m. and the video signal have been developed. Extra heads are mounted on the drum, creating a three-layer recording in the tape. The system could be useful for recording off-air transmissions with Nicam sound. It would however affect compatibility and work is at present being undertaken on establishing an agreed standard.

RADIO BYGONES

The first issue of *Radio Bygones*, a new bi-monthly for the vintage radio enthusiast, is due to appear on August 22nd. It will cover a wide range of vintage equipment, including domestic radio and TV receivers, and will carry articles on restoration and repair, history, reminiscences, museums etc. with colour illustrations. It will also incorporate Chas Miller's well known *Radiophile*. Cover price will be £2·20 for individual copies or £12 for a year's subscription (six issues). For further details contact G.C. Arnold Partners, 8A Corfe View Road, Corfe Mullen, Wimbourne, Dorset BH21 3LZ (0202·658 474).

NEW CATALOGUE

Aerial Techniques (11 Kent Road, Parkstone, Poole, Dorset BH12 2EH) has issued a new enlarged catalogue which is available by return post for 75p.

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Nick Beer, Hugh Allison, Roger Burchett, Stephen A. Featherstone, Eugene Trundle and Joe Cieszynski

Philips VR6462

A common problem with this range of machines is failure of the cassette lift to operate – the cam turns but the lift doesn't move. This is often because the pin has dropped out of lever 242 which is hidden under the main cam wheel 247. Changing the lever isn't too difficult as long as you mark the relevant positions of the gears (in the stop mode) and don't disturb the other levers under the cam. When reassembling, make sure that the threading mechanism is fully unthreaded and that the back-tension lever is on the correct side of the left-hand slider. It's a good idea to remove the loading motor and worm before switching on so that the cam operation can be checked manually.

P.B.

Philips VR6468

This machine produced smeary, monochrome E-E and playback pictures. Panel swapping proved that the fault was on the on-screen display board. It was brought out for access by removing the PCB plug and soldering a ribbon cable between the plug and the PCB. Scope checks revealed that the signal was being dropped across R3122 as the d.c. voltage here was too high (8V instead of 3·5V). There was no base-emitter voltage drop at T7101 because its emitter was floating, the cause being a crack in the print by C2103. **P.B.**

Grundig 2 × 4/1600

When this machine was switched on the head rotated followed a few seconds later by the capstan. This would happen even without a cassette being inserted. None of the +F supplies were present as the F-EIN signal wasn't going high. It comes from IC130, but IC180 wasn't working either – hence the head and capstan rotation. If the threading ring was moved part way it wasn't moved back. The supplies, clock oscillators and resets were o.k. so IC180 (TMS3716-ANL10) was replaced. This cured the problem. **P.B.**

Philips VR6560

The deck would go from play to stop after it had been in use for an hour or so. Just before it went to stop a scraping noise could be heard, then the capstan would cease to rotate. On these machines the capstan bearings are not part of the motor but part of the chassis. After removing the motor and giving the bearings a drop of oil the problem had cleared. **P.B.**

Panasonic NV-MC10 Camcorder

On a couple of occasions customers have complained of excessive motor noise pick-up on the recorded sound track. The cause is an excessively noisy drum motor and the only practical solution is replacement.

We've had the following fault on several occasions with these camcorders: the machine goes dead intermittently and can be brought back to life with a tap on the side. Each time the cause has been a dry-joint at pin 4 of the loading motor drive chip IC6005.

If the customer complains of no EVF picture while the monitor picture is o.k., suspect broken print to the EVF connector. It's mounted straight to the PCB and if the customer twists the plug instead of pulling it the whole connector tends to twist off. When fitting a replacement note the position of the old connector carefully – these connectors fit more than one way. **N.B.**

Panasonic NV-G21

This machine came in with a stock fault – creasing tapes – and indeed the pinch roller was of the unmodified type and faulty. Having replaced this, and its securing cap, I switched on to test and noticed that the capstan shunted then, when a cassette was inserted, the capstan rotated in the wrong direction while its clutch squealed very loudly. Switching off and on again cleared the fault, but after a few minutes it was back again. Previous experience with these machines suggested that a new mode switch would put matters right. One was soon fitted and after this we had no further trouble. **N.B.**

Panasonic VW-CG1 Character Generator

There's a tendency for the customer to start filming and when he calls up a title he's carefully designed and put into the memory he finds that it's no longer there. The cause of the problem is poor contacts in the back-up battery compartment. Cleaning and tightening usually does the trick. This character generator goes with the NV-M7 and NV-MC10. **N.B.**

Panasonic NV-G40

This machine was completely dead with a laced-up tape still in it. The mains fuse had blown (blackened) and the bridge rectifier (D1004) was short-circuit. When this was replaced the fuse held but the power supply wouldn't start. The pulse was being killed by a primary short. Not, as had been the case on a previous occasion, a short in the auto voltage selection i.c. but one in the spike protection diode D1014 (VSD0002). **N.B.**

Ferguson FV30

This machine was completely dead. It was only about five months old and came in a box covered with labels giving the owner's name and address. There were further labels on the machine, leads and remote control unit. These also had messages like "do not drop or scratch". I'm glad he told me – I'd never have thought! Anyway the 1AT mains fuse had died and although the bridge was intact the start-up supply rectifier D11 was found to be leaky. A new fuse and BA159 diode put matters right. **N.B.**

JVC HR7700/Ferguson 3V23

I quoted for a mechanical overhaul – belts, idlers etc. plus loading rollers, audio/control head and video heads. Much to my surprise the customer accepted the rather high price – the machine is a good one for features but the customer had also just bought an FV14.

When work started I soon hit problems. While changing the loading rollers I found that the small PCB for the loading photo-interrupter was cracked, so a replacement had to be ordered. Then when the machine was put on soak a further fault developed – there was no sound or vision in the E-E mode, just a black raster. The V-V switching worked all right and the root cause was absence of the E-E 12V supply. This follows quite a complicated path, originating in the horrendous system control (mechacon) circuit. Here it's derived from the 12V rail by the microcomputer chip via transistor X15 (2SA1020) which had a 900Ω leak between its base and emitter. **N.B.**

Hitachi GP5UK Camera

I bought this colour camera for £15 at a car boot sale, as a non-worker. Its previous owner said that it had worked faultlessly for five years then "gone weird". Rather than have it repaired he'd bought a camcorder and was selling off the camera.

On power up it was obvious that the line oscillator was squegging – its frequency increased from 15 to 20kHz then back again once a second. The 9V rail changed from 3 to 6V at the same repetition frequency while the 50V rail was varying between 25 and 30V. After much fruitless testing of transistors on the regulator board I discovered that the three-pin, in-line socket (the smallest one on this board) was not making through, i.e. the plug/socket was open-circuit on all pins. Careful examination with an eyeglass revealed a varnish-like coating on the pins – strange since the board is not coated. After giving all the pins a good scrape with a screwdriver blade I was rewarded with a startlingly brilliant picture. **H.A.**

Philips VR6470

We've had this fault on a couple of these machines. The symptoms are as follows. At switch on from the mains supply the clock and counter displays flash at a very fast rate; there's no E-E display; and if any of the function keys are touched nothing happens. You then start to scratch your head and look at the circuit diagram. On looking up, the display seems to have cured itself and you now have E-E, but try a function and the display and E-E disappear, with no sign of anything working. Voltage checks will show that all four outputs from the power supply are low and fluctuating. Then the fault clears and the power supply is o.k.

The problem of course is whether something is pulling down the outputs from the power supply or the power supply itself is faulty. I cheated and fitted a new one – it's an all-enclosed unit. There were no shorts on any of the outputs so it was time to get out the scope and look for pulses. The only one that seemed to be missing was that at the collectors of T7001/2. When these transistors were checked out of circuit they seemed to be all right, but the fault was still there when they were replaced. Fitting new ones cleared the fault. A further check revealed that T7001 was actually the cause of the trouble, but it didn't measure faulty – and was the culprit in both machines.

S.A.F.

Memorex VR1700

This machine is a GoldStar clone – my manual for the GoldStar GHV-12321 seems to cover it adequately. Any liquid spilt through the right-hand side of the top seems to end up on the microcomputer chip. Connector P6801 is right in line, and the first indication of trouble is loss of the 9V supply to the front panel. This particular machine came in with the tape partly laced (the right-hand guides had missed the tape), the reel motor running continuously and no functions. **R.B.**

Ferguson 3V52

This portable machine was a new one to me. Luckily (for once!) the fault and the cure were simple, though the owner made a long-winded tale of it. What it amounted to was that the tape was not being fully unlaced as the back-tension arm was jamming against the guide pole. The spindle goes through a bearing in the deck and is held in place by a circlip – a non-existent circlip in this case. A certain amount of dismantling of this very compact machine was required to carry out the repair, but it was better than a syscon fault. **R.B.**

Akai VS1

A fault that's occurred several times with this machine is the appearance of a block of white "space-invader" figures: 180 of them to be exact, in a 20 × 9 block at the centre of the TV screen, flashing on and off in a threatening fashion. They also stop the operation of the centre control-panel keys – display, programme, counter etc. – and won't go away even though playback etc. work all right. The culprit is IC2 (MB88303) on the front, vertical operation panel. This chip is pluggable: could they have been expecting an invasion from space? **E.T.**

JVC GZS5/Ferguson 3V40

A common problem with these excellent little cameras is intermittent contact at the microphone socket. In most cases the socket itself is faultless, being dry-jointed to its mini-PCB. It's worth checking this before ordering a replacement socket.

In cases of failure of the camera on/off switch or the stop/run (record pause) trigger, check the continuity of the appropriate core of the multiway cable that links the camera to the VCR. This usually saves a fruitless dismantle-and-reassemble session. **E.T.**

Hitachi VT220

This machine is similar to the VT120 and others. The problem was an elusive one: at very rare intervals the machine would shut down with the tape fully laced. With the fault present, switching on would bring up the on LED and function displays for a second or two, then the syscon would turn them back to standby with just the clock display remaining. A long soak test and much button stabbing established the fact that the fault showed only when the pause and frame-advance facilities were used – and then only rarely. The cause was a minute dead spot in the capstan motor. **E.T.**

Ferguson 3V39

This machine's capstan motor wouldn't operate in any mode. The relevant power supply lines were correct, but the base of the emitter-follower Q235 in the motor drive amplifier circuit was permanently low. The cause was quickly traced to the inverting gate at pins 3 and 14 of IC4 – resistance checks showed that there was an internal short-circuit at the output pin 14. I mention this because

it's not the first time we've had an internal short in one of these IR2403 chips, which are used in a wide range of models. If while fault tracing you start to move towards one of these buffer chips it's well worth while checking that the input and output logic conditions are correct for the mode concerned.

Another of these machines came in because the "line hold" ran off very intermittently – in other words the drum would slow down. When I eventually managed to make the fault appear I found that there was no sample pulse on the ramp waveform at TP4. Before condemning the servo chip I decided to make a few d.c. checks and discovered that there was no voltage at pin 10, the tracking control input. The cause of the fault was traced to a broken lead inside the sleeving at plug connector 1/4 (i.e. pin 4 of plug 1) on the servo panel. We're beginning to get a number of intermittent faults on these machines due to breaks such as this. **J.C.**

Servicing Compact Disc Players

Part 6

Joe Cieszynski

Last month we saw how the original analogue audio signal is converted into a series of sixteen-bit binary words and the way in which these words are encoded before being stamped on the disc. Fig. 11 in last month's instalment showed the CD frame format and is the point from which we take up the story. Our next concern is with the data added to the frame: this is not audio data but is crucial to the correct operation of a CD player.

Frame Sync

The frames of data stamped on the disc start with a sync section that consists of a 24-bit pattern (plus three merging bits). Fig. 1 shows the binary composition of the frame sync section and the resultant obtained after NRZ-I modulation: this is the pit formation on the disc, and is the only occasion where ten consecutive zeroes occur, thus making it easily identifiable by the player's decoder. As we saw last month all other words – whether they represent audio, subcode or parity bits, have less than ten consecutive zeroes, this being made possible by the eight-to-fourteen bit modulation process.

When the disc is operating at the correct speed the bit rate is 4·3218MHz. Each complete frame consists of six samples of left/right audio information, merging bits, subcode, error correction and frame sync. The total comes to 588 bits per frame.

The frequency of the equal mark-space ratio squarewave shown in Fig. 1 is thus 4·3218MHz/588 – 7·35kHz. Because it appears at the start of each frame a regular 7·35kHz squarewave is present in the off-disc signal. Although not continuous, it's precise and sufficiently definite to enable the disc servo to lock to it – in a similar fashion to the way in which a VCR servo locks to the FG signal. Should the disc speed be incorrect the bit rate will alter and so will the frequency of the 7·35kHz frame signal: this frequency shift can be used to correct the speed via the disc servo.

Error Correction Techniques

Much has been made of the fact that if you bore a half-inch diameter hole in the disc the error correction techniques used will be able to compensate for the lost data. What the advertisers have been putting over is the fact that the system is impervious to large scratches, fingerprints, jam butties etc. Curiously enough this is not always the case, but even if it were the problem could have been overcome far more easily by enclosing the disc in a cartridge, like some of the video ones. Error correction is necessary regardless of customer handling problems. Errors occur frequently during the stamping process: they consist of missing or extra bits. If left uncorrected there would be distortion of the audio playback signal along with pops and crackles.

The domestic CD system employs three forms of error correction, as follows:

(1) Parity. This is used to correct random errors in the encoded audio data.

(2) Cross-interleaved Reed-Solomon Code (CIRC). This is used to correct large errors (burst errors) caused by fingerprints etc.

(3) Cyclic Redundancy Check Code (CRCC). This is used to correct errors in the subcode data – it's not used to correct the audio data.

Before we can look at parity and CRCC it's necessary to understand how the data is rearranged by the CIRC encoder. For simplicity we'll take the process stage by stage.

Fig. 2 represents a frame in which some data is missing. In other words, some of the information required for correct reproduction of the L/R audio signal is missing so that there's momentary distortion. In practice such distor-

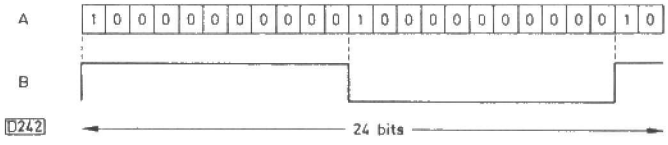


Fig. 1: The frame sync binary format and the resultant after NRZ-I modulation.

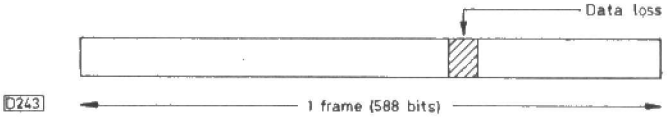


Fig. 2: One frame containing a data dropout.

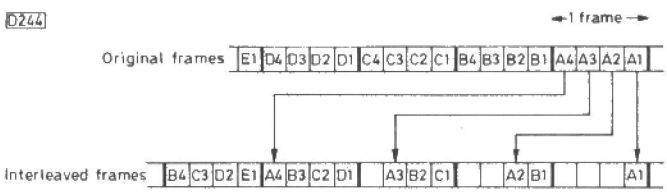


Fig. 3: How the data words are spread around the disc in a defined pattern.

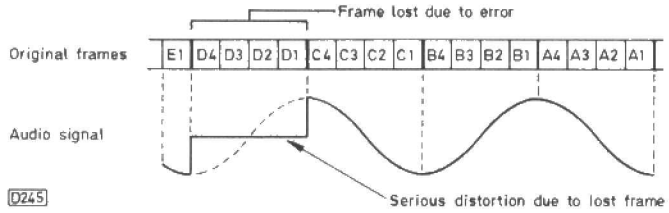


Fig. 4: Without interleaving a small scratch or impurity on the surface of the disc would produce a significant audible error.

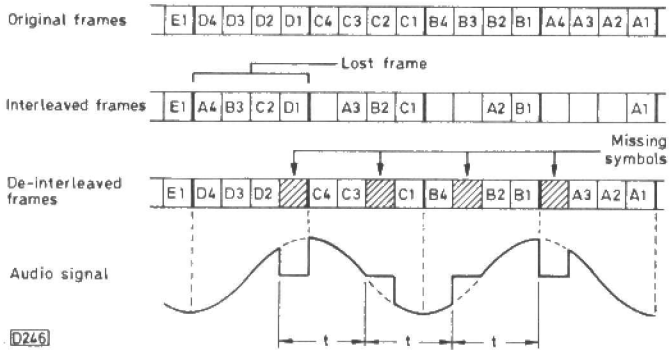


Fig. 5: With interleaving the distortion produced by an imperfection on the disc's surface is scattered after the decoder has de-interleaved the data. Note however the regularity of the distortion.

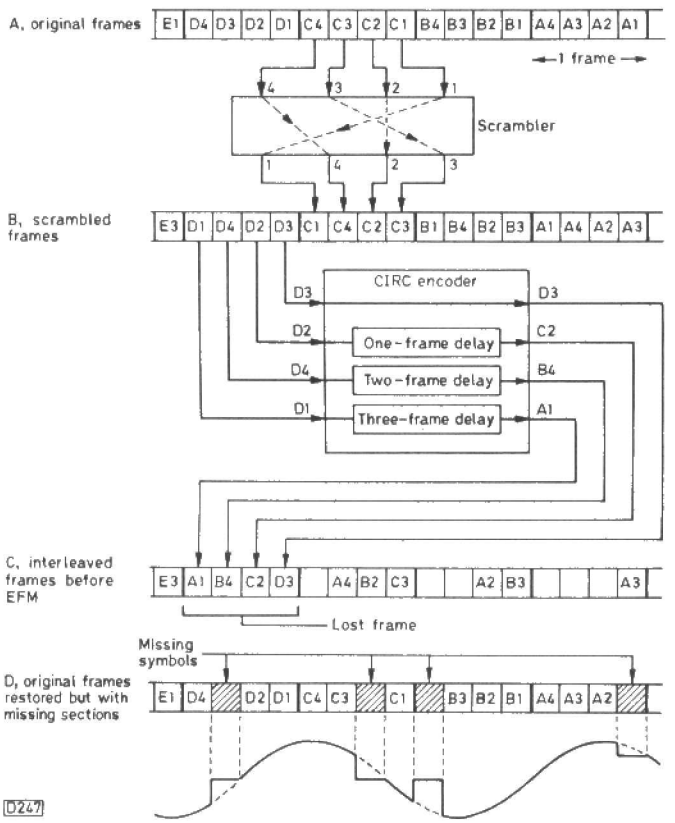


Fig. 6: The Reed-Solomon method of scrambling and interleaving the eight-bit symbols before they are translated to 14-bit words.

tion, which is unacceptable, occurs regularly. Hence the need for error correction.

Data Interleaving

One way to reduce the effect of the error depicted in Fig. 2 is to cross-interleave the eight-bit symbols before EFM takes place. That is, they are scattered among the neighbouring frames. As we have seen previously, a frame is made up of 33 fourteen-bit symbols plus merging bits and frame sync. The following diagrams would be very complex if all these were to be shown, so for clarity we'll assume that there are just four symbols per frame.

Fig. 3 shows the principle of interleaving. The symbols in each original frame are redistributed, but the net result is that each frame still contains the original number of symbols (33 in practice).

Consider the effect of a large error without interleaving, see Fig. 4. The error correction techniques such as parity checking and interpolation, which we'll consider shortly, are limited in their effectiveness and could not replace an entire missing frame. Thus minute blemishes on or in a disc would result in audible errors that would be impossible to hide. Fig. 5 shows an interleaved data stream where, as in Fig. 4, a complete frame has been lost. Note the difference in the resultant audio distortion.

Fig. 5 shows that by scattering the data during encoding, then restoring it during the decoding process, errors too become scattered, making it much easier to hide them in the error-correction stages. A problem remains however. Notice that because of the regular frame rate the errors are now separated by a regular interval t. During development of the system it was discovered that even after further steps had been taken to conceal these errors an audible disturbance occurred because of the regularity of the correction. In other words you could hear the error correction cutting in. To get around this problem the eight-bit symbols are scrambled before interleaving takes place.

Scrambling plus Interleaving

Fig. 6 illustrates this scrambling and interleaving. A, at the top, shows the original frames of Fig. 3. At B they have been passed through a scrambler which rearranges the symbols within each frame. The next step is to pass the signal through the CIRC encoder, which is primarily a network of eight-bit time-delay lines. With the situation depicted, as symbol D2 enters the encoder C2 emerges; as D4 enters, B4 emerges; and so on. Thus the output, C, is not only interleaved but scrambled. This is the signal that, after EFM, is stamped on to the disc.

Let's now consider the effect if, say, the fourth frame is lost, either during the stamping process or because of a scratch on the disc. After decoding (D) the errors will be scattered. They will not occur at regular intervals as they did in Fig. 5 however: inspection of the a.f. waveform shows that the regular error pattern has been removed.

A simple illustration of how this complex encoding process enables the player to remove or, rather, hide dropout errors is to imagine a 1,000 piece jigsaw puzzle. If such a puzzle is completed then someone comes along and removes a group of say forty pieces from the middle the hole created will be very noticeable. If you decided to cover up the area by redrawing the picture using felt-tipped pens the result, even assuming that you are a very competent artist, would remain highly visible. Any small detail in the affected area would have been completely lost, so you would not know how to recreate it. This situation can be likened to data loss where no encoding is employed (Fig. 4).

Now imagine the same jigsaw puzzle as before, but that this time the vandal removes the forty pieces while it's still in an unassembled pile. He still takes the pieces from one

part of the pile, but when the puzzle has been rebuilt the missing pieces will be spread over the whole picture, making them less obvious to the observer and also making it easier for you to fill in the missing parts of the picture. There is also far less chance of small detail being completely lost. This is the effect produced by Reed-Solomon encoding. The frames of data become scattered over the disc so that if three consecutive frames are lost (like our forty pieces from the jigsaw puzzle pile) then, once the frames have been reassembled by the decoder, the data loss will be random – as in Fig. 6.

Error Checks

It's time to consider how the errors are removed or masked. Clearly an audio mute system would be unacceptable, due to the frequency of errors in a disc system. In practice the decoder chip incorporates a number of methods of marking disc errors. First however the decoder must know when an error is present. One check it could make would be to see if the EFM rule has been broken, that is no fewer than two but no more than ten consecutive zeroes and no consecutive ones. This alone is too coarse for complete error detection, so a method of parity checking is used.

P Parity

Before EFM, each eight-bit word is looked at and the number of ones it contains are counted. If the count is an even number an extra one is added (to the P parity, not in the word itself). If the count is an odd number a zero is added. Take the following example:

	Word	*No. of ones*	*Parity*
A	11011000	4 – even	1
B	10110000	3 – odd	0

Say that during playback these words are misread as follows:

	Misreading	*No. of ones*	*Parity*	*Error*
A	10011000	3 – odd	1	Yes
B	10110001	4 – even	0	Yes

This method of detecting whether a single-bit error is present works well, and we will see later how the error, once detected, can be put right. The system does however have a drawback. Consider the case where two errors have been made in reading a number:

Word	*No. of ones*	*Parity*	*Error*
11011000 (original)	4 – even	1	No
10010000 (two errors)	2 – even	1	No (incorrect)

Thus the parity technique cannot be used to detect multiple errors.

Q Parity

Having seen that P parity checking works only when detecting single-bit errors we must next examine the way in which larger errors are detected. In practice this is done

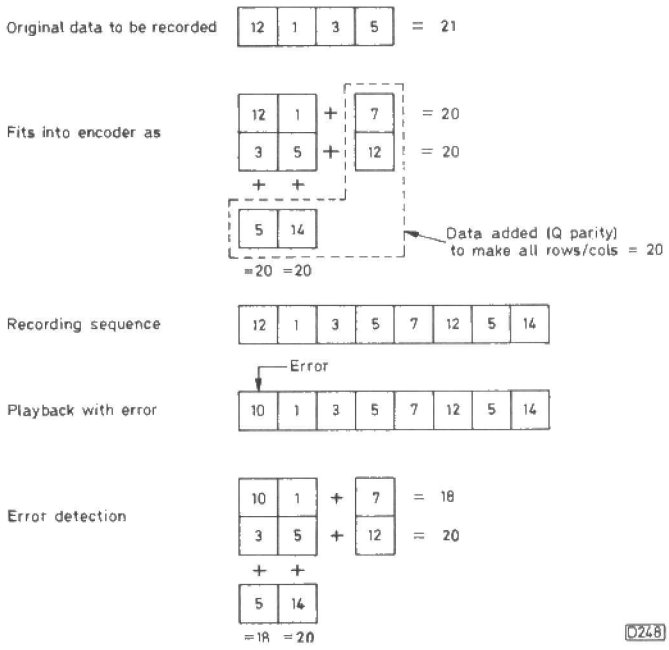


Fig. 7: Illustrating the method of cross-checking an array of words to provide error detection. Note that the decoder will be able to discover the fact that an added check word has been corrupted.

by the CIRC encoder/decoder which does far more than scramble and interleave the data. The encoder adds data that's placed in the Q parity block: the decoder can then use this to detect large errors. The exact format of the added data is still a well-kept secret. This is of no consequence however – the mathematical complexity of such data places it well outside the scope of the present series.

The illustration used by most manufacturers to indicate how this works is shown in Fig. 7. Denary instead of binary numbers are used to simplify the explanation. Using the data in the Q subcode, in this case 7, 12, 5 and 14, the decoder is able to determine not only which word is corrupt but also by how much. In the example shown 3 + 5 + 12 = 20 and 1 + 5 + 14 = 20, so the incorrect data must be in the number 10 which in both cases produces an error of two (18). The correction part of the decoder alters the number 10 to 12 and the data is then once more correct. At this point the Q parity data is discarded, having served its purpose.

This illustration is still a bit misleading, as you may wonder what happens when two words are corrupt. The mathematics involved are in practice much more complex than so far suggested, and the system is well able to handle such an eventuality.

An interesting point that arises from Fig. 7 is that for every block of audio data there's a block of error detection data. Clearly this means that the disc carries large

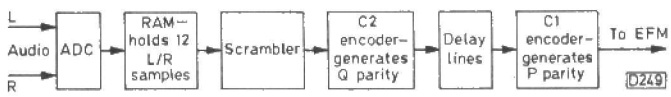


Fig. 8: Block diagram of the basic CIRC encoder.

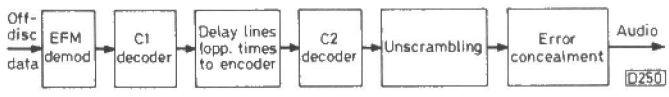


Fig. 9: Block diagram of the basic CIRC decoder.

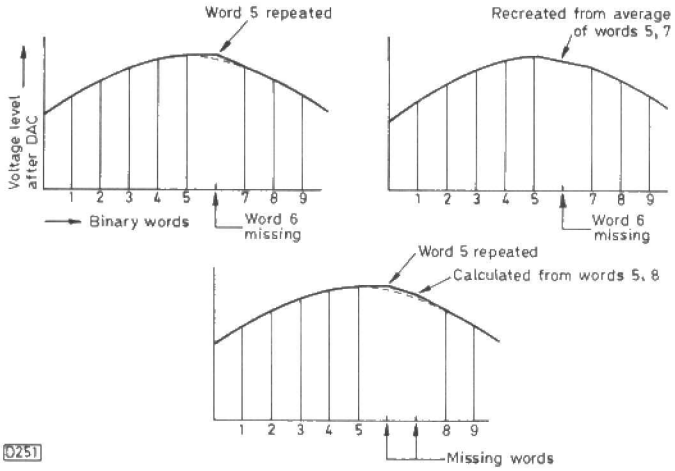


Fig. 10 (top left): Error concealment by holding and if necessary repeating the previous word.

Fig. 11 (top right): Linear interpolation provides improved error concealment.

Fig. 12 (bottom): Previous word holding and linear interpolation are used to conceal multiple errors.

amounts of data which have nothing to do with the digitised audio as such. It raises the question as to whether this data wastes a lot of space on the disc? The answer is yes it does pre-empt a lot of space, but if it enables the high performance for which the compact disc is famous to be attained its presence is justified. To put it another way, would the listener prefer a greater playing time but with constant dropouts and distortion?

CIRC Encoding

Fig. 8 shows the operation of a CIRC encoder in block diagram form. We've already looked at the function of the scrambler and the delay-line sections, so let's next consider the C2 encoder. The 24 scrambled, eight-bit symbols leave the scrambler and pass through the C2 encoder, which generates four Q words of eight bits each. This data is like the added data shown in Fig. 7 and is called the Q parity. After the delay-line section a second set of four words (eight bits each) is mathematically derived in the C1 encoder. This is called P parity and was discussed earlier. The entire data block then passes to the EFM, merging bit addition and frame sync generator sections of the encoder, after which a complete frame will have been formed.

Decoding

During playback (see Fig. 9) 32 eight-bit words (24 audio plus eight P and Q parity words) are fed into the C1 decoder, where the first attempt at error detection and correction is made, using the P parity words. If one incorrect word is detected the C1 decoder will be able to correct this and then pass the remaining 28 words (audio plus Q parity) through to the next stage. If more than one word is found to be incorrect the C1 decoder adds a flag to each symbol, indicating that some symbols in this batch are incorrect. Because of the uneven delay times, the C2 decoder will not receive all the flagged symbols at one time: it can now recognise which symbols are correct and which are incorrect. The C2 decoder, using the Q parity data, can correct up to four incorrect words spread over sixteen frames.

At this point all the minor errors will have been detected and corrected. The problem remains that errors larger than four words cannot be corrected by the C2 decoder. In such a case the C2 decoder will do nothing with the data but simply pass it on to the descrambling section. Because the batches of 24 words (the P and Q parity words have been removed by the C1 and C2 decoders) still have error flags they can be identified by the error-concealment stage which will attempt to hide the errors.

Error Concealment

A number of error concealment techniques can be employed. The crudest is to mute the audio amplifiers when errors of more than four words are detected. This approach has the disadvantage of being clearly audible. It would thus ruin the high performance of which the CD system is capable. For this reason audio mute is used only as a last resort, i.e. when extremely large amounts of data have been lost, usually due to a defective disc or player.

Most CD players employ a combination of error concealment techniques. The one used at any particular time depends on the size and type of error. One technique is previous word holding, where the last good eight-bit word is held in a memory and used to replace the corrupt word. The theory of this is that the distortion introduced will be very slight in comparison with the distortion the corrupt word would have produced. See Fig. 10. In practice most CD players employ a variation on this method: a missing or incorrect word is replaced with one derived by comparing the words on either side of it. This is called linear interpolation – see Fig. 11. The words are actually in 16-bit binary form. Interpolation is performed by an adder and shift register in the decoder.

Where more than one word is lost a variation on the two methods just outlined is used, see Fig. 12. The first error is replaced by the last good word and the next error is corrected by interpolation using the last good word and the next good one.

CIRC System Overview

When the CIRC system as a whole is in operation, even significant errors will have been corrected or concealed by the time the data has passed through the decoder. This brings us back to the half-inch drill. Errors up to such a point can be concealed, after which it's suggested that you fit a smaller bit in your chuck! Realistically, the beauty of the CIRC system is that large fingerprints etc., which would cause errors in any other system, will not impair the reproduction at all.

Those familiar with the CD system will be aware of the fact that the error correction is not as infallible as it may at first appear to be. For example a radial scratch will be concealed but a scratch running in the direction of the tracks can cause such a large error that the system is forced to mute the sound, while the associated tracking error may result in the pickup jumping a number of tracks. Nevertheless in terms of background noise, minor scratches, dust particles etc. CD is the best audio system developed so far.

Subcode Data and CRCC

Next month we'll be looking at the subcode data and its uses, also the third form of error correction, CRCC.

Computer Programmed RC System

Eugene Trundle

As the amount of remotely controlled equipment in the home increases, users are finding themselves faced with an unwanted proliferation of infra-red handsets. Most manufacturers nowadays have available a unit that will control a TV set and a VCR. The trouble is that few users buy these items at the same time, and they seldom buy the same make – the collection of home entertainment gear tends to be built up over the years, coming from a variety of manufacturers. With satellite TV tuners becoming more popular many householders find that they have at least three IR handsets, one for the main TV set, one for the VCR and another one for the sat-box. If the audio centre is remotely controlled a fourth unit will be added to the ensemble.

Head-to-head Devices

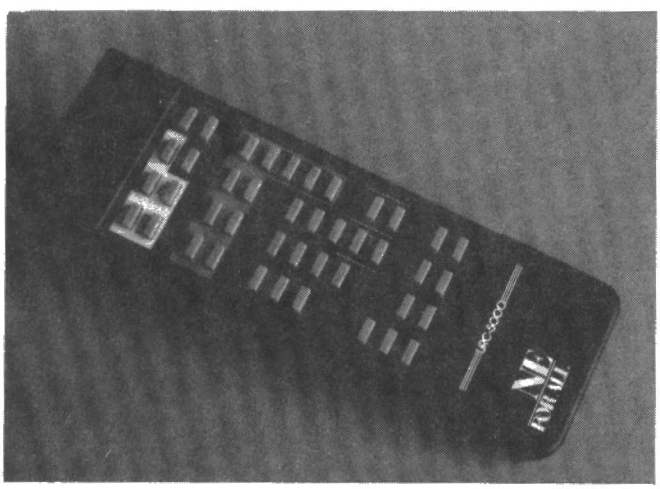
Various "learning" handsets have been produced as a solution to this problem, some of them by setmakers but most of them by independent companies. These can learn the commands of another handset by means of a programming sequence that involves "squirting" the output from the original handset at the new one which then commits the command codes to memory and uses them as required. They have the capability of catering for typically four remotely controlled devices.

These provide a good solution in many cases but are not wholly successful with all command codes. The Philips RC5 and similar "toggled" control systems can be a stumbling block. Another disadvantage is that if you don't have or can't gain access to the original handset there's no way of programming the new "universal" one. Then again the memorised data is held in rather precarious form, vulnerable to wipe-out. Finally some units I've tested since reviewing the Ondra PRC6000 (January 1988 plus letter in the June 1988 issue) have failed or partially failed to learn the commands for some types of equipment.

Holding Codes in ROM

An alternative and potentially more certain way of arranging a universal remote control system is to incorporate a range of control codes in the handset in ROM form or by direct (hard-wired) programming. An example of this is the latest Finlux remote control unit, which contains a diode matrix whose links can be opened or closed, giving control of various VCRs produced by competitors.

A further development along these lines is to provide a large memory bank within the universal controller and to program it, via a computer, with all the remote control codes required. The control code data bank can be held at a central location. With this system the handset can be customised before delivery and subsequently updated as new remotely controlled equipment is acquired. A range of common control codes can be stored in handsets for general sale, and checked by the purchaser during a trial-and-error session. When a wanted code family is found it can be "registered" for instant recall. This is the system used in the new US-designed "One-for-All" universal handset, Model URC5000.



The URC5000 One-for-All handset.

The One-for-All Handset

The URC5000 is similar in size and appearance to the larger TV remote-control handsets, being 190 × 60 ×15mm, with 42 keys. It's powered by four AAA cells and has a single indicator which glows red, yellow or green. The control code memory has a capacity of 8K and, on receipt, will be programmed with a variety of command codes. It's divided into five banks which are accessible via five selection buttons. On the review unit these were marked TV, Cable, VCR1, VCR2 and CD. If control of more than five devices is required the user can arrange for up to eight more.

There's a typical range of function and numerical keys – the REC one requires two keystrokes to operate, to prevent accidental recording. Eight function keys are labelled A to H and will typically control such things as sound balance, bass, treble, track-skip, sweep, colour, dish rotate, LNB polarise, next, time, status and all the peripheral functions the original handset may have had. A stick-on underside fascia can be filled in to provide a user key to the control actions.

A further feature of this handset is its ability (shared with some "head-to-head" types) to control several functions at a single keystroke. Typically this keystroke could be used to switch the TV set on at channel 0, the VCR to record channel 4 and the sat-box to channel 6 simultaneously. Without an inbuilt clock it's difficult to see many practical uses for this facility!

Operation

When you obtain one of these units you have to search through its memory to find the code family for the device – TV set, VCR etc. – you want to control. Say it's a TV set. With the set running you key in "do" and "enter", then operate the relevant device type key, in this case TV. You next operate the power (standby) button. If the set doesn't go off you use the Do 1 key to select another code family, then try standby again. The process can be

repeated, stepping through the code families in the memory, until the set does eventually switch off. When this happens all the other marked keys should operate their designated functions – further keystrokes bring them into operation.

The process is repeated for the other devices to be controlled, using the appropriate device key each time. If a controlled item has more than the standard functions – this applies particularly to such things as teletext, "digital" VCRs and surround-sound decoders – the eight keys A-H will operate them. The process of finding out what these extended functions are is fascinating!

Having brought a code into operation you key up a "blink code" and write down the sequence produced by the indicator LED. It blinks red or green eight times, so you get something like RRGGRGGR (corresponding, incidentally, to binary 00110110, i.e. decimal 54). When you look up this blink code in the appendix supplied you find a table that shows what to key for extended functions. In one example 28 such operations can be carried out, from "antenna" to "sleep" and from "sharpness up" to "a.m./p.m.". Thus even the most comprehensive of handsets can be simulated.

Loading Codes via Computer

The remote control codes for consumer devices are held in a central computer and are available to any interested party on a standard floppy disc. A connecting lead (3-pin handset to male DB-9 serial port connector) is provided to link a handset to a computer, which must be IBM-compatible and have at least 512Kbytes of RAM. The program runs much faster with a hard drive.

The program is called PLUSH. New versions are continually being produced as the codes for new products are added to the library. Once the data is loaded, you start with choices for TV control codes to load into the handset. Other functions permit you to choose VCR, CD etc. codes; read the contents of the handset's memory by code or make/model; print a manufacturer/model chart; print an extended function chart; save selections on disc; restore saved selections; and of course remove/add data in the handset's memory.

Selecting one model will often select others automatically – seen as a group of selections blinking on the computer's screen. This indicates that they all use the same control code family and, as a bonus, you can see which combinations of TV set, VCR etc. will suffer from interaction of remote control commands. For many manufacturers there's a "KIT" entry which selects everything that PLUSH knows about for the brand name concerned.

During the "build" of control-code data for downloading into the handset an indicator gives you an idea of how full the handset's memory will become. It may be necessary to delete some unwanted codes to get the data to fit. Handset loading takes less than a minute.

It may happen that the remote control code you want is not in the library, or that it's listed in another form – under a clone or alternative make. In this case a "help" screen gives advice. Unlisted original handsets can be returned for adding to the library at a central capture station. This process takes a few days by post, and thereafter the codes are available to other users as required. By the time this article appears a "bulletin board", similar to one in operation in the USA, should have been set up by Celtel in the UK. This, via a dedicated telephone number, will provide direct downloading of details of the latest codes and software library updates into your computer. To take advantage of this you need a modem that operates at a 2,400, 1,200 or 300 baud rate.

Dealer's Role

The idea is that participating dealers will equip themselves with the means of programming and updating these universal handsets – many dealers will already have a suitable computer. The software kit (disc and interconnecting lead) costs around £38 plus VAT. A suggested end-user updating charge is £16 including VAT. The updating service is free for the first ninety days from the date of purchase and is carried out centrally by Celtel or locally by the dealer.

On Test

When this review was written the majority of the codes in the library were for US devices. Since a lot of these codes originate in the Far East, many of them apply to equipment sold in the UK. The biggest hole, which is rapidly being filled as Celtel come across and log them, is in codes that originate in Northern Europe and are used by many TV sets and VCRs sold here.

For this reason it would be inappropriate to give a list of what the handset can and can't do – basically it will operate all equipment for which it's programmed. The codes present in the review handset were able to control some but not all of the equipment in my home, at the workshop and in the showroom, including teletext models. Thus in the early days of this product in the UK market customising by Celtel will in some cases be necessary – I understand that they've yet to come across a case that can't be cracked, though some codes (like those that issue a command as the key is *released*!) may present a challenge.

It's my intention to hang on to the handset and report back in a future issue on the results obtained with updated software.

Conclusion

The idea is certainly a good one and it seems to me that this technology has the best chance of overcoming the multi-handset problem. The updating capability is attractive, and the handset has the potential to become a complete household control centre as the necessary hardware and interfaces become available.

More than almost any other product this one depends heavily on support from the importer and good library management. So long as these are maintained the product should have a bright future.

Availability and Price

The importers/service agents are Celtel Ltd., 18 Central Trading Estate, Staines, Middlesex TW18 4WE (telephone 0708 861 404). Those who have an account with SEME can obtain the One-for-All from SEME Ltd., Units 2E and 2F, Saxby Road Industrial Estate, Melton Mowbray, Leics. LE13 1BS (telephone 0664 65 392/66 881).

The retail price is £79·95 inclusive of VAT and discounts are available to bona-fide dealers.

Video Head Life – An Investigation

Steve Beeching, T.Eng.

For many years now the average life of a video head tip has been regarded as being 1,000 hours or more. Some heads last for years in general use however while others can fail just after the first year's warranty has expired. Some guidelines have appeared over the years in the trade. They have been based on general experience rather than systematic testing.

Why have the heads in some types of VCR seemed to last for ever while with other models head failure has occurred so regularly that workshops hold stocks? The video heads in Sanyo Betamax machines usually last for the life of the VCR, i.e. some four-five years with "normal general use". With the Sony SL range of Betamax machines however head life has been the normal average, about three years. As a result of this it was reasonable to change the heads in a Sony machine during its life but not those in Sanyo Betamax models. Similar patterns have been found with VHS machines. The heads in the Panasonic NV8600 series machines outlasted those in the JVC HR3300 series by the same ratio as the Sanyo/ Sony Betamax machines. So it was normal to fit new heads in JVC machines of this vintage but rare to do so with Panasonic models.

The video head wear characteristics of later VHS machines are not so well established. One reason for this is the fact that dealers and trade organisations have tended to concentrate on a particular manufacturer's models. Another is the fact that there are so many different types of machines being operated in varying conditions. Since early 1988 however I've been collaborating with MCES of Manchester in a programme of testing in an attempt to find out which effects and characteristics contribute to video head wear and to produce a guide to longevity. We have had help from rental organisations and manufacturers.

Back Tension

Numerous factors affect head wear. Back tension and the type of back-tension regulator in particular contribute greatly to head life. There are two types of regulation: (1) by mechanical feedback control, (2) by electronic feedback control. The former is the most common. It consists of a tension band with a soft surface to create soft braking friction at the supply spool, the feedback being via a tension arm that reduces the soft braking friction when the tape tension increases. Tension is set within defined limits by means of an adjustable spring bias applied to the tension arm. With electronic tape tension control the amount of reverse current fed to the supply spool motor is varied. Feedback is via an optical sensor that checks the travel of a tension arm. Setting is again by an adjustable spring bias.

Back tension is generally measured in one of two ways. One is to measure the radial force or torque applied by the brake band to the supply spool via the tension arm: inserting a torque measuring cassette will give a reading in g/cm. The other way is to use a tentelometer. This has three prongs in a row – see Fig. 1. The outer prongs are fixed while the centre one drives a meter. When tape is

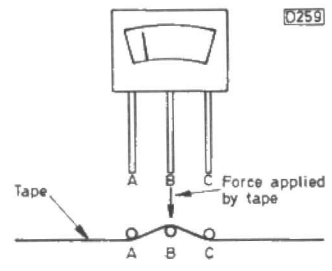


Fig. 1: Use of a tentelometer.

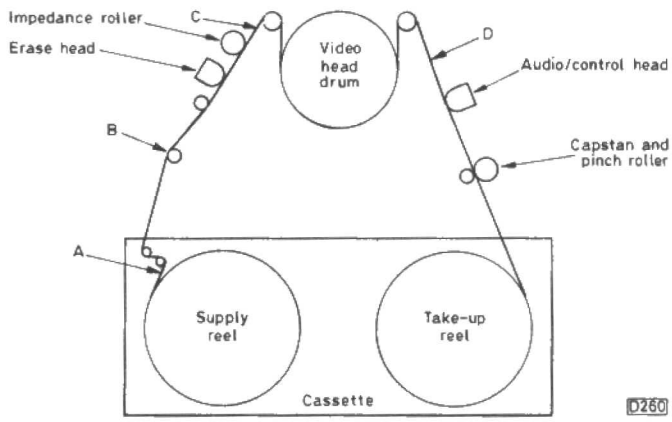


Fig. 2: Tension around a VCR tape deck.

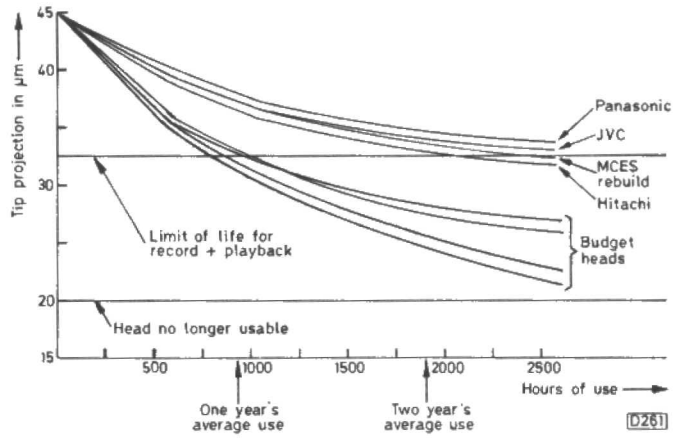


Fig. 3: Chart showing results of tests on head life carried out using prerecorded tapes.

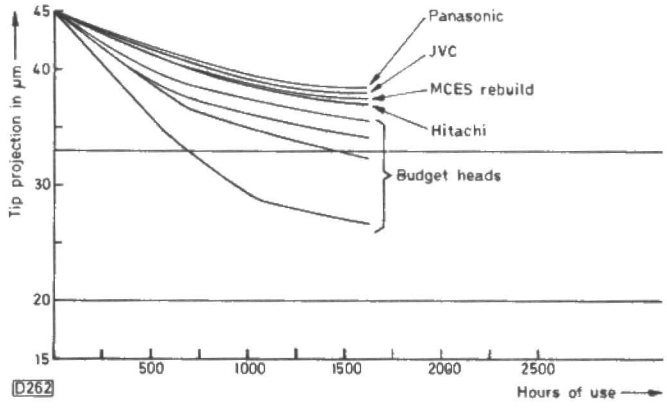


Fig. 4: Chart showing results of tests on head life carried out using new TDK E180HS tapes.

threaded between the prongs the meter indicates tape tension in grams.

A third method, now little used, is to fit a full tape spool to the supply turntable, thread the tape around the tension arm and attach the end to a calibrated spring gauge. Measurement was by pulling the tape with the spring gauge, at the correct constant speed, and taking a reading. This is a hit-and-miss business but it usually enables the back tension to be set within the tolerance band.

A rotary tension gauge measures the torque at the radius in g/cm – where the tension is in grams at radius in centimetres. Given that the radius of a full tape spool is 3cm, it's reasonable to expect that the difference between a reading in g/cm and one in grams is three. But this is true at only one position in the tape path – see Fig. 2. At position A the tape tension on a torque cassette will be in the range 25-30g/cm. A tentelometer will read 8-10g however. When multiplied by a factor of three we get an accurate correlation.

The tension arm is situated at point B. It introduces friction, as do the following erase head and impedance roller. So at C, prior to the head entry guides, we have the only measurable tape tension point that's close to the video heads and accessible to a tentelometer, which will give a reading of around 25-35g. The video head drum assembly adds more friction, and at point D the reading will be 70-100g or more. Thus the important figure is the one obtained at point C. It's at this point that measurement in grams should be made using a tentelometer – unless, that is, the manufacturer gives the setting using a torque cassette as the measuring device.

With some makes of VCR that have still picture facilities a higher back tension is required to give optimum performance in the freeze mode, by avoiding slack tape. This reduces head life significantly.

Beware of using a torque cassette in Panasonic VCRs – the figures given in the service manual may not be correct for this type of gauge. Aim for 20-30g/cm.

Test Results

Now for the results of some of the tests carried out by MCES. In tests on genuine JVC heads at a back tension of 30g/cm the wear was found to be 10μm over 1,500 hours. With the back tension increased to 70g/cm the wear over the same period was 25μm.

Figs. 3 and 4 show the results of head wear tests carried out by MCES under carefully controlled conditions. The results shown in Fig. 3 were obtained using prerecorded tapes which were changed every 24 hours. Back tension was 30g/cm. Fig. 4 shows the results obtained using new TDK E180HS tapes which were rotated every 24 hours and replaced every 96 hours. Back tension was again 30g/cm. Head wear with budget heads was found to be 35 per cent greater than with original manufacturers' grade A heads and MCES rebuilds. For the sake of comparison, average head life characteristics have been assumed, i.e. with the tips worn down by about 12·5μm the user will find that recordings and trick mode displays are poor but it will still be possible to play back prerecorded tapes. When the wear increases to some 25μm the heads become useless. This is a reasonable average but there's more to it than that – see later.

Tests using a Panasonic VCR and the factory-set back tension of 70g/cm (decidedly high) showed that budget heads failed within 500 hours, which represents consider-

ably less than one year's use (average annual VCR use, based on a video industry survey, is 950 hours). Under the same arduous conditions Panasonic heads lasted for 1,000 hours.

Checks on 300 Panasonic VCRs where the head life was below average showed that the back tension was usually set higher than specification. With other manufacturers' machines one would expect to find the same tendency, so it's reasonable to conclude that the back tension should be checked whenever heads have been replaced after early failure.

With Grundig VCRs that use electronic back tension head life is generally good – heads last as long as 4,000 hours and in some cases 6,000 hours. This does not prove that back tension alone is the determinant of head life. Other factors have to be taken into consideration.

Environmental Factors

These include the environmental conditions. For example, a VCR that sits on a carpet has a ten per cent greater wear rate than one that sits on a shelf. Wear can be accelerated by the atmosphere: in a household of heavy smokers the drum and the guides can become contaminated with nicotine, increasing the overall mechanical as well as head wear. Despite the suspicions of many engineers, temperature and humidity have little effect on head life – except when the humidity is excessive and the tape sticks to the drum.

Use of Cleaners

Surprisingly, the use of abrasive head cleaners was found to produce less head wear than expected. Certain types of paper-tape head cleaner clogged the heads, particularly if rewound and reused. Branded abrasive head cleaners such as Scotch contribute very little to head wear, but in cases where the clogging was exceptionally bad this and other types of cleaner proved to be ineffective – even engineer cleaning with a fluid and cotton bud proved difficult.

It was also shown in tests that some examples of wet video head cleaners, when used dry, removed the head drum coating and damaged the smooth surface of the drum, increasing the friction around the drum and thus accelerating head wear. Some obscure types of wet and dry video head cleaners had adverse effects on the video drums because the fluid contaminated and marked the surface. It's also been found that there's a risk of head damage if too much fluid is used, as the drum is still wet when the tape is inserted, causing snatching and breakage of the head tips.

Rental Tapes

Consistent use of rental tapes has also proved to contribute to reduced head life. This was tested by running machines continuously for up to 2,500 hours with rented tapes, but the exact cause of the increased wear is not known. One suggestion is that the tapes may be damaged by constant use in different types of machines. Another suggestion relates more to the tape coating. Different manufacturers use different types of coating lubricant to reduce friction, and deposits of these lubricants may be left on the head drum and tape guide poles. If a single manufacturer's tape is used, all well and good, but if different types are used the suggestion is that they could react adversely, creating chemicals that increase head wear. There was an example of this in the early Seventies when a particular type of tape had front face and backing compounds that reacted, forming a white powder that would be deposited throughout the tape, clogging the video heads and making the tape unusable. This sort of thing could happen when different brands of tape are used.

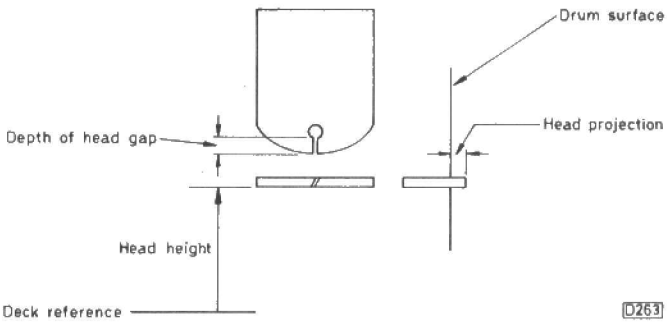


Fig. 5: Video head tip characteristics.

Test Methods

Finally, some details of the testing procedures and criteria. All the video head drums used in the tests had grooves around the circumference. In order to eliminate the effects of drum wear, measurements (see Fig. 5) were taken from the bottom of the groove to the drum surface and then to the end of the video head tip in order to ascertain the exact tip projection. All measurements were carried out using sophisticated high-accuracy Japanese video head measuring equipment with a resolution accuracy of 0·2μm, costing some £100,000 a time.

To maintain consistency, the upper drums were removed from each machine and left overnight prior to measurement being made each morning.

The average video head tip projection is 45μm. Average head wear/life limits were mentioned earlier on, in connection with Figs. 3 and 4. Worn heads were measured for inductance as well as tip projection and were then checked in actual machines. Well over a thousand heads were used in the tests, 200 of each type returned to MCES to be reheaded being checked.

Depth of head gap determines head life, but the depth required varies with different makes of head. This seems certain to be due to the material used in the manufacture of the heads. There comes a point with any head when playback of prerecorded tapes is still possible but recordings give poor results. With JVC heads it was found that the minimum projection is 20μm whilst with Panasonic heads it's as low as 8-10μm. With budget-type heads the minimum projection is around 25-26μm. For the purpose of the tests MCES mounted all heads with the same initial head projection (45μm).

The facts presented in this article have been substantiated by accurate analysis. They show by measurement what experienced engineers have always known in their heart of hearts. Budget heads cost a lot less than manufacturers' grade A heads of course, so in deciding what to use the relative economics of head life and cost have to be weighed, i.e. is it in a particular case worth fitting low-cost/relatively short-life heads or expensive/long-life heads?

In closing I would like to thank John Glenton of MCES, Manchester, for providing the information and for carrying out checks that took many, many hours. Also Nick Beer who provided statistical assistance.

Satellite TV Servicing Aid

D.J. Stephenson, B.A., I.Eng.

The simple servicing aid described in this article will interface a Marconi or Grundig satellite TV dish/head unit with any make of receiver. It uses readily available components.

Now that low-cost equipment is available in high street shops to enable medium- and high-power satellite TV transmissions to be received most TV/video technicians will probably be expected to turn their hands to servicing satellite TV receivers. Thankfully the future of the monster dishes required for low-power satellite TV reception looks bleak.

The Problem

When you encounter a faulty satellite TV receiver that has to be taken back to the workshop for servicing one of the main problems is its dish/LNB assembly interfacing requirements. The chances are good that the receiver/dish combination installed in the workshop is incompatible with the receiver brought in for service. It's the polariser system that causes the problem. Some systems use a single coaxial cable between the receiver and the dish assembly while others require one or more extra polariser leads. Lack of standardisation between the designs of different manufacturers has always been troublesome in the domestic electronics trade. The idea of having say ten different dishes available to cater for as many manufacturers is clearly out of the question. Elaborate test generators that can be used to simulate a satellite TV transmission are available but tend to be expensive and out of the range of the average workshop at present. So what can be done in the meantime to overcome this problem? The low-cost servicing aid described in this article provides supplies to feed the head units of two common dish/head systems currently on the market and a d.c.-isolated 960-1,700MHz signal to feed to any make of satellite TV receiver.

Dish/LNB Combinations

Most readily available Astra equipment uses a 65cm offset-focus dish and a low-cost Marconi LNB. Together these give good results, even in heavy rain. An 85cm dish is necessary north of the border however. The LNB, feedhorn and polariser are fitted into a single strong casting which gives the impression that it would survive a 20ft fall on to concrete without damage. I wouldn't like to test this though! At the time of writing the manufacturers who use the Marconi head unit include Amstrad, Sakura (made in the UK!) and Alba.

Another system in reasonable supply is the upmarket Grundig STR20 – a lower noise figure LNB has apparently been introduced with this. It's said that the original version gave poor results in comparison with the competition. The current version has an LNB that's made in Japan and should in theory give a marginally improved picture in comparison with the Marconi unit. In practice it doesn't seem to make a lot of difference but no doubt the specification and neat dish appearance will lead to substantial sales. The delicate looking feedhorn/polariser assembly has to be bolted to the LNB with the correct orientation via a rubber O ring that prevents entry of moisture. Don't drop this one from the top of the ladder!

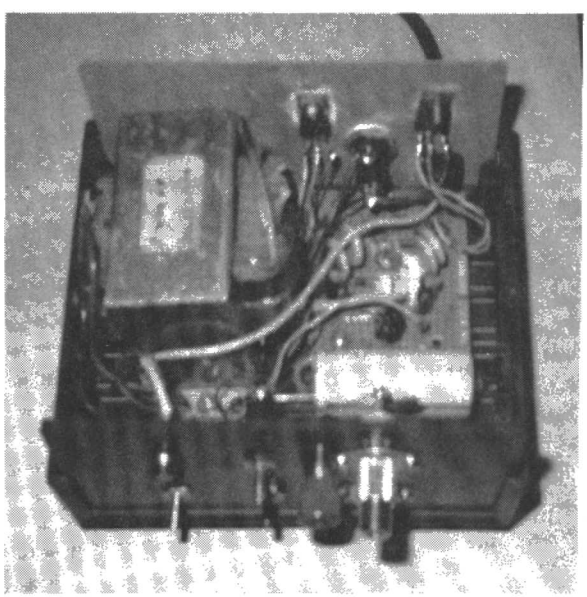
These two LNB/dish assemblies have been chosen as the basis for the workshop servicing aid.

The Marconi and Grundig LNBs both have a solid-state ferrite polariser that's embedded in the feedhorn. On command, the magnetic field instantly rotates the plane of polarisation without the need to rotate the aerial probe mechanically, as was the case with earlier designs intended for low-power satellite TV reception. This method is fast becoming an industry standard. It has the following advantages over the now largely obsolete servo methods of polarisation: (1) It won't seize up in frost. (2) It won't wear out. (3) The cabling requirements are less. (4) It gives faster polarisation changes. The main disadvantage of this method is an increase of approximately 0·3dB in the noise figure. In practice this is negligible and can be ignored.

Head Unit Voltage Requirements

Of all the current LNB assemblies the Marconi one is perhaps the most ingenious. The various subsections are preassembled in one casting and all the polarisation and LNB supply voltages required are sent up the screened coaxial cable. This improves the neatness and greatly reduces the cost and complexity of an installation. In fact perfectly acceptable picture quality can be obtained using standard u.h.f. aerial cable provided the run is less than ten metres or so.

A voltage threshold system is used to control the polariser: approximately 13·5V is required for vertical polarisation, 16·5V for horizontal polarisation. The LNB circuitry is happy to work at either voltage. These d.c. voltages are sent up the cable to the head unit from the matched receiver. The 960-1,700MHz down-converted signal from the LNB is fed back to the receiver. Trading in equipment that uses these units is by far the easiest and



Internal construction of the unit.

most profitable from the installation point of view.

The Grundig STR20 system doesn't use the method of control outlined above. Instead it has an extra lead to provide the supply to the ferrite polariser, the earth return being via the screen of the coaxial cable. Zero voltage gives vertical polarisation, 12V horizontal polarisation. Unfortunately the extra lead can add considerable cost to the installation, especially if the special bonded coaxial cable with the extra polariser lead is bought. Some customers find that the use of separate, cheaper cable is unsightly and unacceptable.

I wouldn't be surprised if most future designs use the method adopted by Marconi. There are some systems, including those marketed by ITT and Tatung, that have two extra polarisation leads. This further complicates weather-proofing.

Interface Unit Design

The interface unit is designed to operate with either a Marconi or a Grundig dish/head system. It provides all the necessary voltages to feed the head unit, with manual switching for vertical/horizontal polarisation. A d.c. isolated loop-through is provided to link the 960-1,700MHz output from the LNB to any make of receiver. Thus no d.c. voltages from the interface unit are applied to the receiver under test and likewise no d.c. voltages from the receiver are allowed to reach the head unit.

As previously mentioned, for a Marconi head unit we require 13·5V and 16·5V d.c. supplies while for a Grundig unit we require a 15V supply for the LNB and a switched 0-12V supply for the polariser. Since the Marconi unit is threshold-operated at slightly below 12V a 12V supply can be used to give vertical polarisation and a 16V supply to give horizontal polarisation. The 12V supply can also be used to meet the Grundig unit's polarisation requirements. The LNB supply for the Grundig unit can be anything in the range 15-24V, so a 16V supply is acceptable. Thus all that the interface unit needs to do is to provide 12V and 16V supplies. These will power either of these two head units. Fig. 1 shows the interface unit in block diagram form.

Components list

C1	4,700µF, 63V electro.	R1-2	470Ω, 0·5W
C2-5	0·1µF disc ceramic	RV1	1kΩ cermet
C6-7	22µF, 25V electro.		
C8	22pF disc ceramic	IC1	7812
		IC2	7815
F1	315mAT		
D1-4	1A bridge rectifier, e.g. BY164 or RS261-328 or 4 × BY127 etc.		
D5-8	1N4001		
T1	50VA mains transformer with 15-30V secondary		
SKT1, 2	Panel-mounting coaxial sockets		
SW1	DPDT subminiature switch		
SW2, 3	SPDT subminiature switches		
TP1	Terminal post		

Instrument case, e.g. Tandy 130 × 125 × 68mm type
Plastic strain relief bush
Insulated mounting kit for the 7815 chip
F connector/standard coaxial conversion plugs (optional)
Mains plug
Mounting bolts, nuts and washers for the coaxial plugs
2-core mains cable
20mm panel mounted fuseholder (e.g. Tandy)
5 × 10cm piece of matrix board (Veroboard)

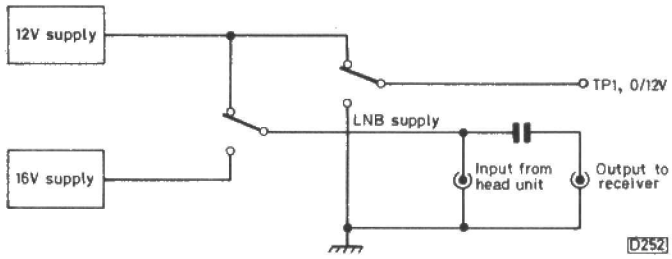


Fig. 1: Block diagram of the head assembly/receiver interfacing unit.

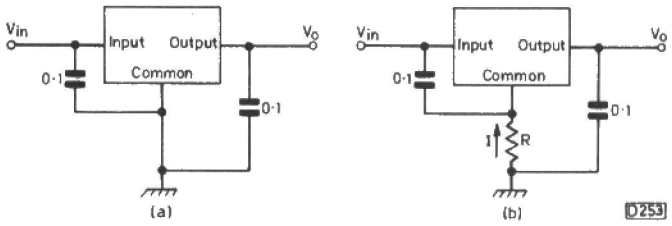


Fig. 2: Basic circuits for 78 series regulator i.c.s.

Either 12V or 16V is sent to supply the LNB depending on the setting of the single-pole, two-way LNB supply switch. This also corresponds to the two polarisation voltages required by the Marconi head unit. With a Grundig dish/head unit this switch is left in the 16V position and the extra polarisation lead is connected to the 0/12V output (TP1). Another single-pole, two-way switch selects 0V or 12V.

The interfacing unit was designed around the 78 series of voltage regulator i.c.s which all have internal overload, thermal and short-circuit protection. The latter is particularly important as it's commonplace to find shorts in F connector plug wiring. A 7812 gives an output of 12V ±0·5V from an input in the range 14·5-30V while a 7815 gives 15V ±0·6V from an input in the range 17·5-30V. Both chips contain 18 transistors, two zener diodes and 20 resistors. By adding a simple programming resistor in the common earth lead 78 series chips will provide a higher output voltage, the penalty being slightly poorer regulation. This technique is used to obtain the 16V supply from the 7815 chip. See Fig. 2.

The input voltage Vin must be at least 2·5V greater than the output voltage Vo. Vo is equal to Vr + IR, where Vr is the basic regulator voltage. A typical value for I is 1·5mA. Thus to obtain 16V from a 15V chip

$$R = Vo - Vr/I = 16 - 15/0{\cdot}0015 = \text{approximately } 1k\Omega.$$

Since I varies with different chips R should be adjustable.

Because the input voltage range is wide the choice of mains transformer is also wide. The d.c. output from a 15V secondary winding will, when rectified and developed across a large-value reservoir capacitor, be

$$Vout = 15V \times 1{\cdot}414 = 21{\cdot}2V.$$

So any transformer whose secondary winding is in the range 15-30V can be used. In the prototype unit I used a

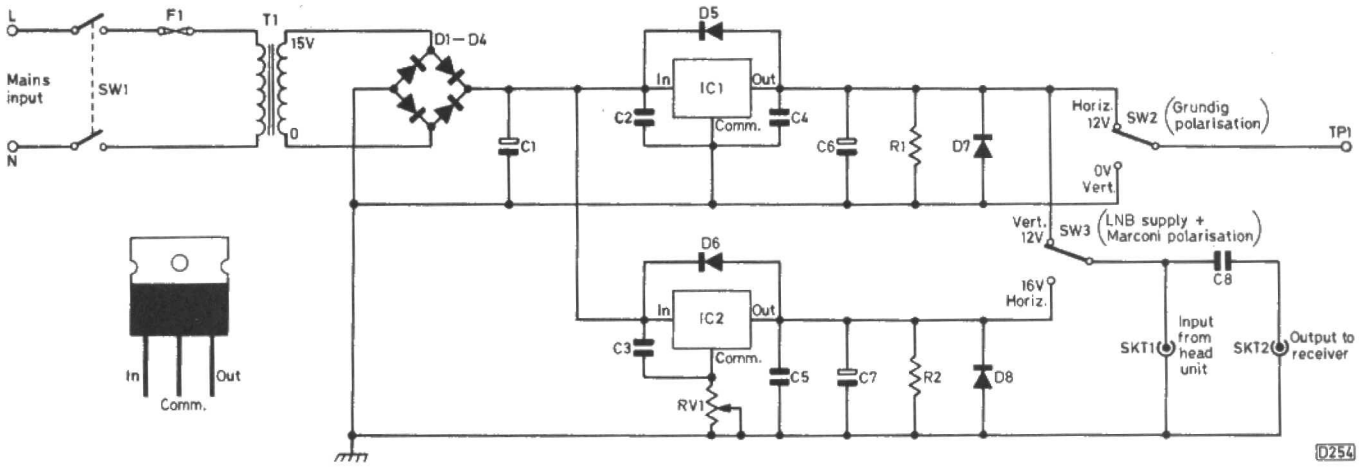


Fig. 3: Full circuit of the interfacing unit.

transformer taken from a scrap Sanyo Betamax VCR. If one is not available a suitable 50VA, 15V transformer can be obtained from RS Components/Electromail and various other component suppliers.

Fig. 3 shows the complete circuit. 0·1μF disc ceramic capacitors provide r.f. bypassing at the inputs and outputs of the chips to prevent oscillation and reduce noise. D5-D8 provide protection for the chips under prolonged reverse voltage conditions. R1 and R2 provide constant loads for the regulator chps. RV1 is set to obtain a 16V output from IC2.

The series d.c. blocking capacitor C8 forms a high-pass filter in conjunction with the shunt 75Ω impedance (R) of the cable. The frequency to be bypassed is approximately 1GHz. At 3dB down the capacitor's reactance Xc is equal to R. So

$$R = 1/(2\pi fC),\ C = 1/(2\pi fR)$$
$$C = 1/(6{\cdot}28 \times 10^9 \times 7{\cdot}5 \times 10)$$
$$= 2{\cdot}1 \times 10^{-12}F$$
$$= 2{\cdot}2pF.$$

The value has been made ten times larger to allow for tolerances and approximations. Thus the value chosen for C8 is 22pF. For a belt-and-braces approach two 47pF capacitors could be used in series to cover the unlikely possibility that a single capacitor might go short-circuit, causing possible damage to the receiver.

Construction

The prototype unit was built on a piece of matrix board measuring about 5 × 10cm. A plastic instrument case was then used to house the transformer and circuit board. For about £5 you can obtain a suitable case measuring 130 × 125 × 68mm from your local Tandy store. This case is ideal since it has a thick plastic front panel that can be easily drilled and filed and a metal rear panel that can be used as a heatsink for the regulator chips. There's a precut ovoid hole in the rear panel to facilitate fitting a strain relief bush for the two-core mains cable. A full parts list is provided for readers' convenience.

Extra care was taken to make the leads to and from the high-frequency areas very short (less than 3cm). Except for the mains switch the other switches and sockets are best grouped together as closely as possible to keep the wiring short. The d.c. blocking capacitor C8 is best wired directly between the centre pins of the adjacently mounted sockets SKT1 and SKT2. At high frequencies the stray reactive effects of the internal wiring can significantly affect the signal-to-noise ratio and introduce instability. The LNB input socket and the signal output socket are of a standard panel-mounted u.h.f. type. For maximum flexibility a pair of F connector in-line conversion plugs may be useful. This will avoid the need for extra F connector sockets and associated wiring.

Another point worth mentioning is that the common terminal (centre pin) is connected to the heatsink surface with 78 series chips. Thus if the 16V supply chip (7815) isn't insulated from chassis RV1 will be shorted out and the output obtained will be 15V. This will lead to intermittent and unpredictable threshold switching of the polariser when a Marconi head unit is connected – it had me stumped for a few minutes during the testing stage.

After assembly and before connection to the dish/head unit and a test receiver measure the various outputs and check that they are correct with all settings of the switches. Any mistakes here could ruin the head unit and/or receiver. Check also that no d.c. is present at SKT2 (the one to which the receiver is connected).

Use

After testing connect the head unit to SKT1 and a receiver to SKT2. Switch on the interface unit and the receiver. Most makes of receiver indicate whether vertical or horizontal polarisation is correct for the channel selected. Operate the 0/12V polarisation switch SW2 or the LNB supply switch SW3 to obtain the appropriate polarisation conditions. In the case of the Grundig head unit the extra polarisation lead is connected to TP1.

We've found the interface unit to be very useful in the workshop for servicing satellite TV receivers and testing them prior to installation. My particular installation uses the Marconi head unit. I've used it successfully with many makes of receiver via the interface unit. There's no noticeable deterioration in the signal level or quality with the interface unit in use and it can be left switched on for any length of time (to deal with intermittent faults) without overheating.

It's a wise precaution to check the d.c. supplies provided by a receiver since this is a possible fault condition. A short stub of coaxial cable terminated with an F connector is useful for making this test – otherwise the top of the unit will have to be removed. It's not advisable to have measuring points on the front panel as the extra wiring could lead to stability problems.

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Mike Adye, Alfred Damp, J.G. Grieve, Chris Avis, Hugh MacMullen, J.K. Potts and Nick Beer

Philips NC3 Chassis

This set was dead and we found that C2483 had exploded. R3475 hadn't been fitted correctly at the factory, as a result of which C2483 which is rated at 25V had some 50V across it. Naturally C2483 had taken exception as had the 5V regulator 7480 and diode 4480. **P.B.**

Philips CX1120

The symptom was no results. On investigation the line oscillator and driver stages were found to be working but the drive was insufficient to turn on the line output transistor. T534 (BC637) had low gain. **P.B.**

National TC361

When the set was cold the lower part of the picture was blanked out. A burst of freezer and heat from a hairdryer revealed that C857 was almost open-circuit. **P.B.**

Philips 25KX1201 Portable

The black-level controls can cause grey-scale changes in these sets. Fit the revised type, part no. 100 10029 – the suspect type was made by PREH. **P.B.**

Contec KT8135

Although we've had a number of these sets in I've never come across this fault before – the top of the picture was stretched out and the bottom was cramped, while a four-inch hum bar punctuated and severely distorted the display. I found that C336 (220μF, 50V) had gone low in value, a replacement putting matters right.

It's quite common to come across one of these sets with an intermittently grainy picture. The cause is a defective or dry-jointed SAW filter. We've never had to change a tuner. **M.A.**

Saisho CT142R/Matsui 1410

No operation with the power supply resonating at approximately 400Hz is generally due to a defective line output transformer. Disconnect pin 6 of the transformer and the resonating will stop – you will also get a short, high-pitched whistle from the power supply to indicate that the excessive load has been relieved. Continuity checks between pins 4 and 2 then 6 and 9, after disconnection, will confirm the diagnosis. Prices are high, so it's best to obtain a pro forma from Mastercare before you give the customer an estimate. In addition this fault will usually damage IC6001 (STR451) unless care is exercised. **M.A.**

Pioneer 2201/2501/2801

Various chrominance and luminance faults have been traced to the U4606B chroma processor chip IV21. Any of the following symptoms can be displayed: (1) no brightness; (2) absence of one primary colour; (3) no chrominance; (4) no luminance; (5) over-saturation of one primary colour; (6) absence of one primary colour on teletext only; (7) over-saturation of one primary colour on teletext only. **A.D.**

Hitachi CPT2224 (NP81CQ Chassis)

The picture was over-bright on the left-hand side, getting darker towards the right-hand side of the screen. A check on the 200V supply to the RGB output stages showed that it was only 76V. R715, the surge limiter in the 200V supply circuit, had burnt and changed value – it read 66kΩ. **A.D.**

Philips KT3 Chassis

This set suffered from field bounce, though the picture was o.k. if the field was underscanned. As a start we tried the TDA2571 sync/line generator chip then several other components on the sync panel. The cause of the trouble was eventually traced to the field scan coupling capacitor C1521 (470μF). **A.D.**

Philips CP90 Chassis

This has proved to be a very reliable chassis to date. We have however had a couple with low, garbled sound due to the earphone socket — plug in earphones and you find that everything is o.k. In both cases the owner preferred bypassing the socket to replacing it. **J.G.G.**

Thorn 9000 Chassis

Here's a daft one. This set had very poor line linearity and adjustment of the linearity control affected the right-hand side of the picture. Someone had fitted the coil backwards. **C.A.**

Philips CTX-E Chassis

The sound was o.k. but the raster was blank, with 0·5V at pin 7 of the TDA3560 colour decoder chip. A scope check at pin 7 of the line output transformer (bottom end of the e.h.t. overwinding) showed that very high amplitude line pulses were present, suggesting that C2565 (39nF) was open-circuit. Bridging it with the workshop 47nF test capacitor made no difference however. Close examination revealed that C2565 had a fractured connection at one end and a replacement restored the set to normal operation. Does anyone want an open-circuit 47nF test capacitor?! **C.A.**

Rediffusion Mk 3 Chassis

This set would operate for a short while then trip. We found that the h.t. rail was at 285V instead of 270V, posing a nasty threat to the thyristors in the line output stage and the tube's heaters. The 42V feedback voltage from the line output stage to the power supply regulator, via 6R33 and 6D8, was low at 35V as the 1μF reservoir

capacitor 6C25 had dried up. Replacing this increased the feedback voltage to 40V and lowered the h.t. to 270V. **C.A.**

B and K 467 CRT Tester

This useful instrument has served us well for five years. Recently however the "remove shorts" button ceased to function. This double-pole, two-way switch discharges a capacitor between offending grids and cathodes, an activity that eventually (and predictably) burnt out the switch contacts. It's part of the main pushbutton unit, which looked like a mind-boggling replacement job. So instead we prised away the back of this end switch and removed the two slide contacts. The back was then re-fitted and used as a connection point for six extension leads which were then wired to the equivalent connections on an RS Components biased toggle switch (order no. 316-620). This switch was mounted through the right-hand side of the right-angled top escutcheon plate so that the switch protrudes inside the lead storage compartment and can be pushed down from the top to operate. There's ample room here for this replacement switch, which is much beefier than the original one and works very successfully. **C.A.**

Philips CTX-E Chassis

The h.t. in this set measured only about 60V. We eventually found that one of the 6·8V zener diodes 6325/6323 had a forward resistance of around 500Ω instead of the customary 1,000Ω. **H.MacM.**

Philips K30 Chassis

These sets are normally very reliable, but this one had very bad luminance striations. The cause was eventually traced to D422 which measured 2kΩ in both directions. As this was a blanking circuit fault it took some time to trace — the contrast and brightness voltage ranges were normal. **H.MacM.**

Fidelity 14in. Portable

We've had two of these sets in for self channel changing. When the first one came in we spent some time changing all the chips etc. on the front remote control panel, all to no avail. Eventually we achieved a cure by cutting a piece of stout plastic to the size of the panel, fitting this over the print side and then adding a similarly cut piece of heavy pie tinfoil. The latter was earthed to the nearest point and then to the c.r.t.'s Aquadag coating. Spurious static around the cabinet plastic had been tripping the remote control system — the set worked perfectly with the panel outside the cabinet. **H.MacM.**

Ferguson TX10 Chassis

This set had received previous attention. The problem was a blown chopper transistor and h.t. fuse, which had been replaced. After resoldering all the usual joints in the chopper circuit and replacing the transistor and fuse the set worked for ten minutes then the transistor and fuse blew again. We next replaced the TDA2582 chopper control chip and checked all the associated components. After doing this we still had no joy and decided that the only thing to do was to replace the chopper transformer. On removing the metal chassis strut we found that pin 10 of this transformer was dry-jointed. Resoldering provided a complete cure. Note that pin 10 is visible only when the strut has been removed. **J.K.P**

B and O MX2000

This NordMende made set had very low, distorted sound. The audio circuit is pretty complex, with pseudo-stereo and audio enhancement included. I checked the supplies to the various stages and found that these were all in order. Next I injected a signal into the output chips. This produced an ear-splitting sound as the volume was still right up to hear the distorted off-air sound . . . Assuming that the fault was earlier on in the sound channel I decided to freeze the f.m. detector chip ID35. This proved to be a fruitful move but the chip itself wasn't the cause of the trouble – the culprit was the 6MHz filter directly behind it. **N.B.**

Salora 20J20 (J Chassis)

There was a strange series of events with this set. First the height would drop slightly then go back up. Next the width would come in then go out again. After this the brightness would vary slightly then return to its previous level. The raster would flare up a bright blue with flyback lines, the channel indicator would return to no. 1, the sound and vision would disappear then a severely reduced raster would gradually appear in the middle of the screen, overbright (white) with flyback lines and no picture content. At this point the 200V rail had dropped to 89V. Being familiar with these sets, my first suspect was the LF0041 Ipsalo chip HB1. But it proved blameless, as did the tripler and combi transformer. After getting to work with the hairdryer and freezer we discovered that the TDA2594 sync/line generator chip was responsible. **N.B.**

Salora J Chassis/Hitachi CPT2625 etc

No go was the fault — a not uncommon one with Salora sets. We found that the 22Ω surge limiter resistor was open-circuit as both the BUW41 switching transistors TB700 and TB701 had gone short-circuit. After replacing these items we checked C514, the 1,000μF reservoir capacitor for the 8·5V rail, as this tends to go leaky causing start-up troubles. The set still didn't start, as the LF0041 Ipsalo chip had been damaged. When this had been replaced the set worked well. **N.B.**

Sony KV1440

The report said that the sound level varied. We found that after some hours the sound would gradually decrease then rise steadily. The cause of the trouble was a temperature-dependent leak in Q014 (type DTC1124) on board B. **N.B.**

Panasonic TX2480 (Alpha One Chassis)

The complaint with this set was no sound or picture. A raster was present and the standby LED was on all the time. Fairly obviously this was a control microcomputer fault (IC1203). The 5V supply was present and there were clock pulses at pin 3. There was no SDA data at pin 2 however, the pull-up being only 1·3V. Lifting the pin restored the pull-up to 4·8V and a new chip (MAB8461PT134) solved the problem. **N.B.**

Long-distance Television

Roger Bunney

There's lots of news and reception to report this month. Sporadic E conditions became active from the first week in May and have continued since, though with occasional lulls. The excellent weather – heatwaves, high pressure and clear, cloudless days – brought improved tropospheric conditions, so one way or other there were plenty of signals to be seen. F2 layer activity has slumped as far as Band I TV is concerned, though slight auroral activity was noted on a few occasion. The log, mainly SpE, is as follows:

5/5/89 TVE (Spain) chs. E2, 3, 4; TVE-2 E2; RAI (Italy) IA, B; RTP (Portugal) E2, 3; CST (Czechoslovakia) R2; RTA (Algeria) E5.

6/5/89 SVT (Sweden) E2; TSS (USSR) R1, 2, 3; RAI IA. An SVT-1 MS ping in ch. E8 was noted by Simon Hamer while an aurora brought unidentified low-level Scandinavian ch. E2, 3, 4 signals in Aberdeen

8/5/89 Arabic music/speech heard in Band I.

10/5/89 RAI IA, B; TVE E2; +PTT (Switzerland) E3, 4; JRT (Yugoslavia) E4; TVA (Italian free station) IA plus Telemarket at 47·86MHz.

11/5/89 TVE E2; RAI IA, B; TVA IA.

12/5/89 TVE E2; RAI IA, B.

13/5/89 TSS R2.

15/5/89 TVE E2, 3, 4; CST R1; +PTT E2.

16/5/89 TVE E2, 3.

17/5/89 TSS R1.

18/5/89 TSS R1, 2; MTV (Hungary) R1; RAI IA; Canal Plus (France) L3; TVE E2, 3, 4; TVE-2 E2.

19/5/89 TVE E2.

20/5/89 TSS R1, 2, 3, 4, 5; MTV R1, 2, 4; TVR (Romania) R3; CST R1, 2; TVP (Poland) R1, 2, 3, 5; RAI IA, B; TVA IA; TVE E2, 3, 4; TVE-2 E2; RTP E3; JRT E3, 4; RTS (Albania) IC; ETP (Greece) E3; ORF (Austria) E2a, 4; ARD (W. Germany) E2, 3, 4; +PTT E3, 4; SVT E2; Canal Plus L2, 3, 4.

22/5/89 RAI IA, B; TVE E2, 3.

25/5/89 TSS R1, 2; YLE (Finland) E3.

26/5/89 RAI IA, B; ARD E2; Canal Plus L2, 3, 4; TVE E2, 3, 4: RTP E2; NRK (Norway) E2, 3; SVT E2; YLE E3, 4. Simon Hamer noted an unidentified ch. E3 reflection and a ch. A2 signal (525 lines), also unidentified, during the evening, the result of auroral activity.

27/5/89 RAI IA, B; TDF (France) L2, 4; TVE E2, 3, 4; TVE-2 E2; RTP E3; RTS IC; TSS R1.

28/5/89 RUV (Iceland) E4; SVT E2; YLE E4; NRK E2, 3, 4; TVE E2; RTP E3; RAI IA.

29/5/89 TVE E2; RAI IA; JRT E3; TVR R2; TSS R1.

30/5/89 RAI IA, B; Telemarket 47·86MHz; TVE E2, 3, 4; ORF E2a, 4; JRT E3, 4; TDF L3; TSS R1.

2/6/89 RAI IA.

3/6/89 TSS R1; RAI IA, B.

4/6/89 RAI IA; TRE (Italian free station – Tele Radio Ercalano) E2.

5/6/89 RAI IA, B; TRE E2; EPT E3; TVE E2, 3, 4.

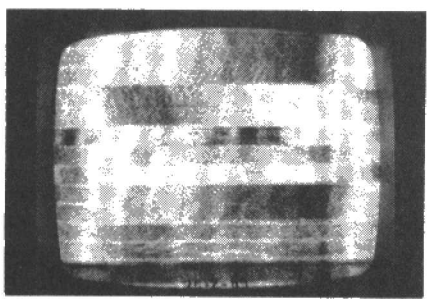
Interesting to note the increased reception of Italian free stations – TVA, TRE and Telemarket for example – during the period, indicating an increase in such transmissions. These low-budget operations often fill in time with material taken from satellite downlinks – CNN has been seen via Telemarket for example! In addition to TVA and Telemarket, Tim Anderson logged a new transmitter that signed itself Canale 3 Teleronalnd, Napoli, A. Travella with phone number. Satellite downlink material can also be seen during improved tropospheric conditions – during May Simon Hamer (South Wales) logged Sat 1 on ch. E49 from W. Germany.

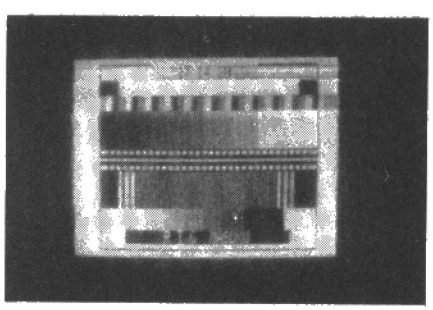
On the 14, 15 and 16th Cyril Willis (King's Lynn) positively identified Gwelo (ZTV – Zimbabwe) at around 1800-1830. He noted unidentified, smeary pictures on the 6th (E3) and 30th (E2). This would be either TE or a combination of TE/SpE propagation.

There were minor tropospheric openings on the 7th and 8th. These were followed by a lull, but from the 17th-21st there was good Band III/u.h.f. reception from W. Germany, the Benelux countries and Denmark (TV1 and TV2) in most parts of England and East Scotland. Roger Fussell in the west logged TVE ch. E37, and Band III signals from NRK just made it to north Wales.

The best tropospheric reception however was during the extremely hot period of May 26-28th. Signals were received from E. Germany, Norway (Band III), Sweden (Band III/u.h.f.), Denmark (TV1, 2), most regions of W. Germany (Band III/u.h.f.), French networks including La 5 and M6, Spain (chs. E9, 12 received in Birmingham) and at very high levels the Benelux countries. Other reception included AFRTS (American Forces) ch. A80 on the Dutch/German border and of course RTE (Ireland) on many channels in the western UK. Danish channels received in the western UK included E5/6/7/8/10/31 (DR-1) and E22/27/30/53 (TV2). RTL+ was seen in the UK south of Scotland on chs. E7/21/27/36, also of course Sat 1 on ch. E36.

The ch. E5 (Band III SpE) reception from Algeria on May 5th was fortunately confirmed by caption and an-





Left: The Iranian FUBK test pattern received via F2 layer propagation by Ryn Muntjewerff (Holland) this February, on ch. E2. Centre: Unusual C Band reception by Ian Waller from Intelsat at 21·5°W. Left: RTG Gabon test pattern received by Ian Waller via the Intelsat 1°W eastern hemispherical beam.

nouncer, during a two minute period. Transmitter source is likely to have been M. Cid at 150kW e.r.p.

There was low-level auroral activity on May 23rd (with NRK in Band I) and 24th.

An extremely active month then. My thanks to the following for sending in logs and reception reports: David Oliver (Birmingham), Bill Cotterill (Tipton), Brian Renforth (Newcastle), Garry Smith (Derby), Tim Anderson (St Leonards), Peter Schubert (Rainham), Iain Menzies (Aberdeen), Roger Fussell (Torpoint), Simon Hamer (Powys) and Cyril Willis (King's Lynn).

During end May/early June I was on holiday at Bonchurch, south Isle of Wight, armed with the latest Yoko 4·5in. TV set, the Triax UFO aerial and a Les Wallen 55MHz helical aerial. Interference from local sources was chronic in Band I while the Band III and u.h.f. channels were dominated by French transmissions. The aerials were mounted on a short eight-foot wooden pole that just cleared a large cast-iron gutter. I'd used this system before at a nearby site, some three miles to the west. The proximity of the gutter and use of a dry wooden pole did seem to degrade reception. Previously I used a 12ft metal, 1in. sleeved mast. For optimum results, particularly with the helical aerial in Band I, use of a metal support mast (counterpoise) does seem advisable.

News Items

Holland: Two advertisement-financed, satellite-distributed TV services are due to come into operation this autumn. TV-10 will be based in Milan using an Esselte channel and will transmit during 1630-2300 CET. Radio-Tele-Veronique will be based in Luxembourg and use an Astra or Eutelsat downlink, with twelve hours a day of programmes.

The Nederlands-2 test pattern is now the FUBK type with circle and the identification "PTT NED.2". Other networks continue to use the PM5544.

West Germany: The RTL+ (German) service is now being transmitted by Wessel ch. E52 and Dusseldorf/Burscheid ch. E36. From 1100-1300 and from RTL+D close down till 0600 these transmitters carry the Tele 5 programme.

Spain: Catalan Radio and Television Corporation started transmissions at the end of April in ch. E33. The aim is for thirty hours weekly of local/popular programmes. Barcelona is to have a new TV/telecomms tower which will be 260m high atop a 448m hill. The project is due for completion in time for the 1992 Summer Olympiad. TVE has carried out experimental HDTV transmissions over the Catalan network, using the Japanese 1,125-line standard.

Satellite TV

The Intelsat craft previously at 60°E has been repositioned to take over at 1°W. As a result the downlinks have lifted out of the noise. Norge TV moved l.f., adjacent to TVN (Infofilm), the two scrambled Swedish programmes are still present and there's an additional Norwegian feed at approximately 11·66GHz, using MAC encoding and intended for cable services. The satellite was seen one night after 2400 testing five vertically polarised transponders on approximately 11·06, 11·18, 11·20, 11·50 and 11·59GHz – so keep a watch out for more activity.

There's a suggestion that TVE-2 will replace NRK on the Eutelsat craft at 10°E this autumn, with PAL and no scrambling. The German version of TRT-Turkey (TDS) may replace 3SAT. Several private Spanish channels propose to use downlinks via the Eutelsat craft at 16°E, starting this autumn. PanAmSat at 45°W is to have a "gaming channel" which will operate for 24 hours a day with PAL.

A European Dish Owners Channel (EDOC) is to start a 1·5 hour service twice a month providing information on channel updates, new products etc. Pakistan is to launch its first communications craft, Badra, next year and Arabsat is planning to bring into operation a new series of craft from 1992. The Spanish Hispasat craft is due to be launched in December 1991. TVRO ownership has been deregulated in Spain and Argentina.

No UK Channel 6

At the end of April the Department of Trade and Industry announced that as a result of the minimal coverage that a sixth u.h.f. TV channel could achieve in the UK without interfering with other services no further work on the proposal would take place. The maximum coverage would be some seventeen per cent of the population, and this would exclude the London region. It was felt that new forthcoming technology might offer better prospects for a sixth service.

Test Card Guide

A third edition of the *Guide to World-Wide Television Test Cards* has been published by HS Publications, 7 Epping Close, Derby DE3 4HR. It's in A5 format with soft back and has some 60 pages packed with information on test cards, TV systems, broadcasting companies, etc. Highly recommended at £4·95 UK, £5·95 Europe and £7·25 elsewhere inclusive of postage (air).

VHS System Developments

George Cole

Some interesting new VHS equipment was shown in prototype form by JVC and Panasonic at this summer's Chicago Consumer Electronics Show.

Dual-cassette Capability

In particular both companies showed VCRs that can play VHS and VHS-C cassettes without the need for an adaptor. The dual-system VCRs have loading trays with indentations for both types of cassette. Users simply insert cassettes into the appropriate slot. The operation is analogous to multi-play CD video players which accommodate several disc sizes.

Cassette size is sensed by the VCR automatically, the appropriate tape threading procedure then being carried out. Fig. 1 gives details of the arrangements used in the Panasonic machine. This VCR uses a newly developed adaptive tension servo system that protects the tape by adjusting the tension for each type of cassette, and an adaptive torque system to control tape winding and feeding. There's also a half-load tape thread arrangement for the VHS fast-search indexing system. This is shown at (b) in Fig. 1.

No prices or launch dates for these machines have been announced.

Multi-standard Machines

Another domestic Panasonic machine of great interest provides multi-standard operation. The company points

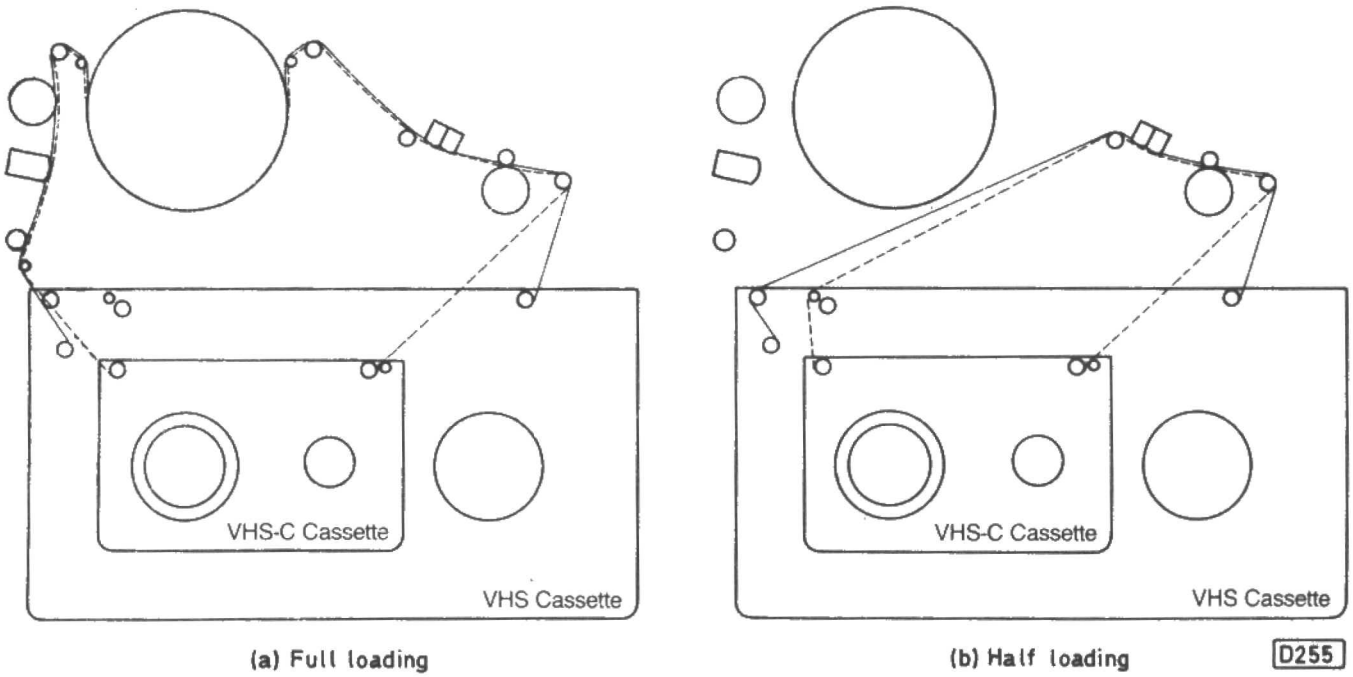
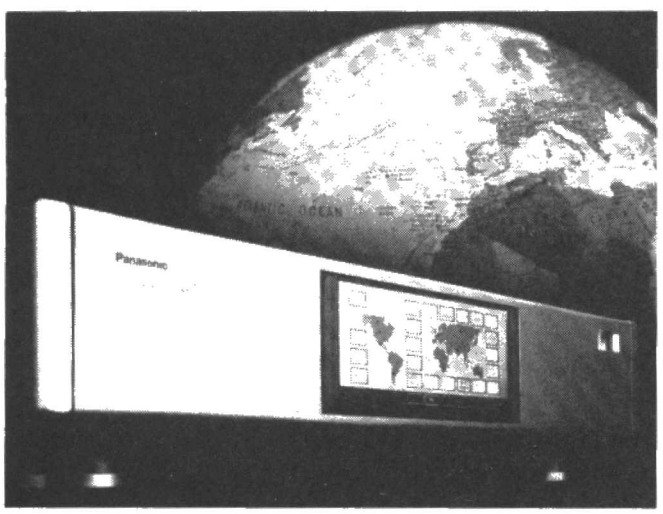


Fig. 1: Panasonic's VHS/VHS-C cassette playing system.



Panasonic's NTSC/PAL/SECAM multi-standard VCR.

Panasonic's VHS/VHS-C compatible VRC.

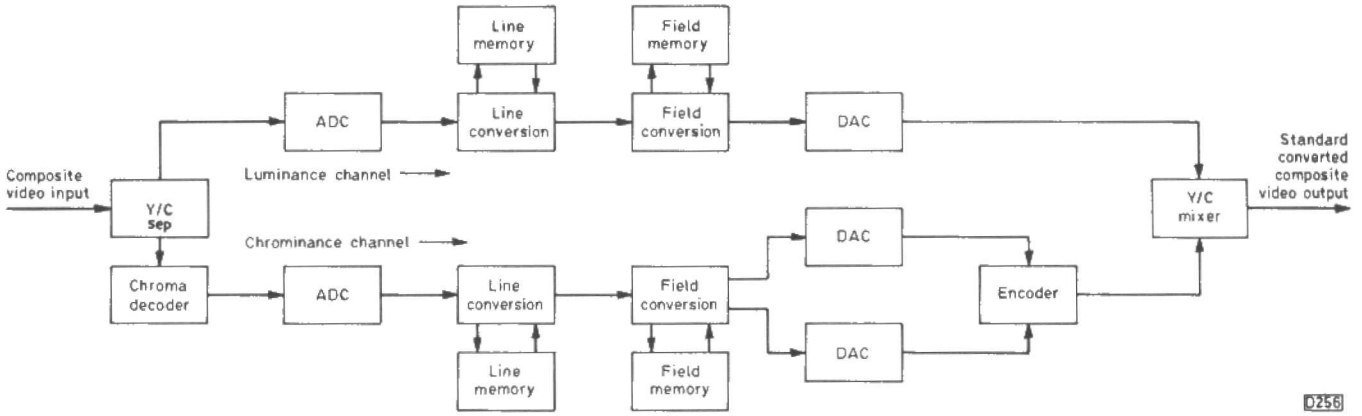


Fig. 2: Block diagram of the standards conversion system used in Panasonic's multi-standard VCR.

out that now VCR penetration has reached nearly 70 per cent in the USA and Japan, 60 per cent in the UK and 45 per cent in mainland Europe there's a need for trans-world tape exchange to be made simpler and cheaper. The multi-standard machine has an intriguing atlas of the world on its fascia. This divides the globe in accordance with the TV systems used in particular areas. The idea is that when you touch the area of the panel corresponding to your country of residence the VCR automatically adjusts the TV/video signals to the local standard!

Incidentally, this is not the same as the Panasonic VCR Model NV-L28, which was recently launched in the UK. This latter machine offers playback of NTSC video tapes via certain PAL TV receivers. The NV-L28 uses digital circuitry to convert the NTSC chrominance signals into PAL form: there's no conversion of the number of lines or the field frequency. It relies on the fact that some modern 625-line PAL receivers will lock to a 525-line, 60Hz field signal.

Fig. 2 shows a simplified block diagram of the signal processing sections in the new multi-standard machine. Line, field and chrominance conversion are required for conversion from 525/60/NTSC to 625/50/PAL and vice versa. The incoming video is first separated into its luminance and chrominance components. The latter has to be decoded to U and V form, after which analogue-to-digital conversion is undertaken in both channels. Line conversion in the luminance channel uses a 2·2Mbit DRAM while the same process in the chrominance channel uses a 1·1Mbit DRAM. The original lines are digitally analysed and new lines are then created from pairs of the original ones. Fig. 3(a) gives an idea of the process. Field conversion is done by writing the digital luminance and chrominance signals into field memories serially, then reading them out asynchronously, i.e. a 50Hz PAL signal is read out as a 60Hz signal and vice versa. Fig. 3(b) shows the effect. For chrominance conversion the digitised U and V signals are restored to analogue form then encoded in the form required – see Fig. 4.

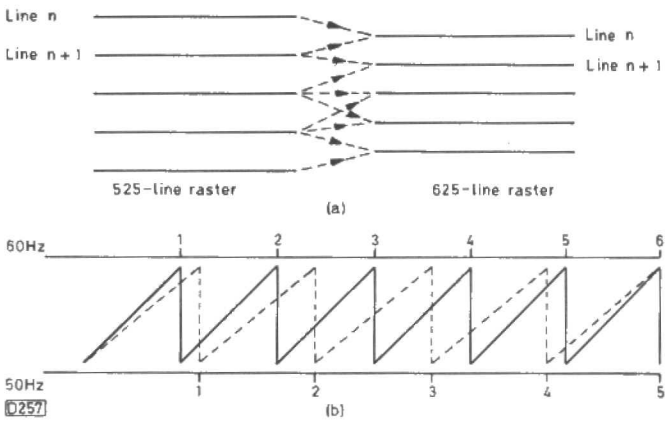


Fig. 3: Interpolation of pairs of lines to provide 625/525 line conversion (a); the effect of asynchronous memory readout to provide 50/60Hz field conversion (b).

The machine has servo control circuitry that automatically adjusts the tape and head drum speeds. Alas no prices or launch dates have been announced.

Miscellaneous Developments

New, longer running VHS-C and S-VHS-C cassettes were also shown by JVC and Panasonic. These will give European users 45 minutes' playing time in the SP mode and 90 minutes in the LP mode.

With more than a nod towards the Video 8 Walkman, JVC showed a personal communications system that consists of a stand-alone VHS-C recorder/player, a high-resolution LCD colour monitor, a palm-sized CCD colour camera, a small tuner and a battery pack.

At the other end of the scale there was a giant 100in. high-quality LCD projector complete with Dolby Pro-Logic surround sound. By attaching an anamorphic lens to the projector lens users can convert the screen aspect ratio from 4:3 to 16:9. As the saying goes, follow that!

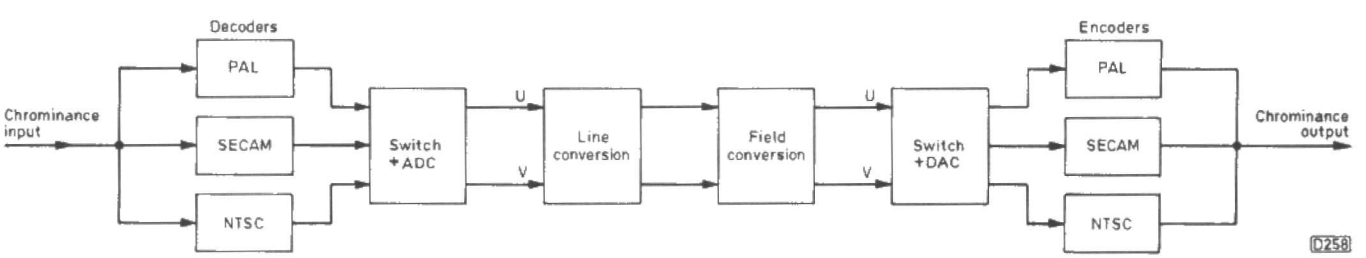


Fig. 4: Block diagram of the chroma conversion system.

Small-screen Sets

Malcolm Burrell

Whilst the living room in most homes contains a large-screen TV set, small-screen sets are to be found elsewhere in ever larger numbers. But the combination of soaring repair costs and ever falling retail prices means that more and more monochrome portables are coming on offer at jumble sales and the like, often with only a simple fault. In fact there are quite a lot of bargains around.

Reliability and c.r.t. life are fairly good, particularly with models from the Far East. The most common fatalities arise from a sudden descent! Later sets of UK or Continental manufacture fare less well due to their flimsy cabinets and trim, also inadequate tuning mechanisms.

Economics

Renovation may at first sight seem uneconomical, since the shelves of large retailers boast a fair selection of such sets, particularly those with very small screens, at modest prices. For those of us who have spent a fair part of our lives staggering up flights of stairs beneath the weight of various 26in. monsters however there's pleasure in being able to hold a complete TV set in the palm of one's hand. This makes the idea of occasional spare-time renovation more attractive. There's always the possibility of a reasonable resale profit – in fact there's the possibility of a specialist business here!

Sets that are badly damaged or suffer from some obscure fault tend to accumulate in odd corners of the workshop. They can serve as a useful source of spares, including presentation parts. Cabinet repair is not impossible however. There are ways and means!

Cabinet Restoration

One little Philips portable came to me in a new livery dedicated to a famous pop group. Having prised the text and other decorative material (including a furry cat!) from the top I found that there was an unsightly scar. It was easily concealed beneath a thin coat of matt black spray enamel.

Given a receiver that works but has a cracked or holed cabinet, you can fasten webbing across the aperture which is filled once the initial layer of epoxy has hardened. Shape and smooth the repair, then mask any portions that are not to be painted. So many portable TV sets have white or black cabinets: why not brighten up your shop with some in a different colour? Remember that several light coats of spray enamel are preferable to a deluge.

Power Supplies

It's the power supplies of such receivers that take the biggest caning of course, so this is very often where the fault(s) will lay. Intermittent or infrequent use, together with relatively meagre component ratings, contribute to the premature demise of many semiconductor devices in this area.

A Prinzvision TV121 that seemed to be completely dead arrived in the workshop not long since. It boasted a substantial mains transformer, and measurements across the PCB plug connector showed that this provided no output. Since the fuses hadn't suffered I jumped to the incorrect conclusion that the transformer was probably the culprit and spent a considerable time checking it. Attention was eventually turned to the bridge rectifier circuit, where two of the diodes were found to be open-circuit and the other two short-circuit. Replacement restored a quite neat little set to normal operation.

Tubes and Speakers

A National 5010G 5in. TV/radio combination looked reasonably healthy apart from a broken tube and a lot of rust in the battery compartment. There had been a Binatone set of similar vintage in the corner since it had succumbed to its owner's temper, but the tube was intact. It was a perfect fit in the National set physically, but some minor changes were needed. With the tube in the National set the cathode was connected to pin 1, which in most such tubes is internally connected to pin 5. Making the cathode connection at pin 2 and the first anode connection at pin 6 got things working, then the next very common problem became apparent – distorted sound due to a displaced speaker cone. These small speakers don't like dampness and physical shock. Fortunately I keep a small selection, and one was soon fitted. A subsequent scrub and polish resulted in another set once more in full operational condition.

Colour Portables

Colour portables have been around since the days of the Granada Colourette and the little 13in. Sony sets. Until comparatively recently they have usually been for mains operation only. Many that appear in the second-hand market suffer because of their obscurity. Attempts at repair have often been made, generally without success. This leaves the ultimate repairer with the puzzle as to what the actual original fault was, or maybe what some original component was? Some of the current cheaper models on offer in the High Street seem to have obsolescence built in – spares prices quoted by sole distributors are often a large percentage of the cost of a new set! Perhaps we've already reached the throw-away age as far as portable colour sets are concerned.

A Philips KT3

A colleague nevertheless decided to have a go with a promising looking Pye colour portable fitted with the KT3 chassis. It was clean and was simply dead. No, it wasn't the 4·7Ω surge limiter resistor: there was in fact some life in the set which had simply shut down. After disconnecting the input to the e.h.t. tripler there was a loud noise from the speaker – until the volume was turned down. When the tripler was replaced we had audio and e.h.t. but still no picture. Apart from a dry-joint on the line output transformer it turned out that the components in series with the earthy side of the e.h.t. overwinding were in a sorry state. The two capacitors C563 and C564 (both 47nF) were open-circuit, and their associated parallel resistors R563 and R564 (both 1MΩ) were more than a little sad. Replacing these components helped, but normal operation wasn't restored until the TDA3560 colour decoder chip had been changed.

So here's the moral. With a bit of determination, we can put new life into the sets with small screens!

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £2 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

AMSTRAD VCR4500

Occasionally this machine spoils tapes. The problem seems to be in the area of the pressure/pinch roller and capstan: the bottom of the tape is given a concertina effect that distorts the picture. Turning the pinch roller round seemed to do the trick for a while but the problem then returned.

This is a fairly common occurrence with this series of machines. It's usually caused by excessive friction in the take-up clutch, as a result of which there is far too much take-up torque. Spares can be obtained from CPC of Preston.

PHILIPS G8 CHASSIS

When this set is switched on from cold the picture comes on with colour impurity around the edges. The degaussing circuit cleans the picture up after eight-ten seconds. There seems to be something wrong with the degaussing circuit though the thermistor and associated resistors have been replaced. There's something else odd about the set: reasonable but not sharp focus can be obtained. I'm wondering whether a new tripler would put this right. The tube is a regunned type with good emission.

There shouldn't be anything slow about the degaussing process — it should be over long before the tube has warmed up. If you see *moving colour patterns* on the screen for the first eight-ten seconds the degaussing circuit is faulty. If not, carefully setting up the purity should do the trick provided the tube is not faulty. Regarding the focus problem, if the focus control passes through an optimum point any shortcoming will be due to the tube itself.

FERGUSON 3V29

The problem is with the drum speed. In play or record it might run correctly for a while after which it suddenly jumps to full speed.

The most common cause of the drum running at high speed is loss of the FG signal which enters the servo board at connectors 212 and 213. There should be a 1·5kHz sinewave at connector 211, and this should be present at pin 2 of IC201. If it's missing, suspect an open-circuit FG generator in the motor – check continuity and connections with an ohmmeter. If the sinewave is present IC201 is suspect, especially if the voltage at pin 10 is higher than 3V d.c.

PANASONIC TX2200

There's no raster or sound. A sudden flash of an unstable raster is obtained for a couple of seconds on changing channels, then it's back to a blank screen. The voltages developed by the rectifier diodes D852, D851 and D853 in the chopper circuit are 28V, 120V and 16V respectively.

The voltages you quote are about right, and this is confirmed by the momentary screen light-up on channel change. It seems that the tube is biased off. Check the audio/video switching chip IC371 and its control line, and in particular the action of muting transistor Q504 whose collector should be at 12V to unblank the screen.

LOGIC VR950

There's an intermittent fault on this machine. On playback it would sometimes go to E-E, then unthread with the standby LED flashing. After restoring power the machine would again shut down shortly afterwards. The fault would then clear for several days. Replacing the take-up reel photo-interrupter seemed to clear the fault but it then started to occur at the beginning of a timed recording or the end of one-touch operation. The start and end phototransistors have been replaced but the fault persists. All voltages seem to be correct and I'm beginning to suspect that the microcomputer control chip IC602 is the cause.

Replacing the TMP4746N chip would be a logical step, but before doing so it might be wise to monitor the key syscon inputs (reel sensor, head-drum flip-flop and end sensor) with an oscilloscope, idealy a double-beam type. The problem of course is that you need to be watching when the fault crops up . . . **Feedback:** Q601 in the cassette LED sensor circuit eventually proved to be the culprit — it was going open-circuit randomly, giving a failed-LED signal at pin 11 of IC602. It's a DTC144A device and turned out to be on the expensive side.

GRUNDIG 1510

When this set is first switched on there's a small raster and a pulsing effect. The 255V and 250V h.t. rails remain stable and the only way in which the set will settle down is by adjusting the line hold control. In addition there's no video. If the FKI and SP controls are adjusted a raster consisting of colour highlights is obtained. Is this a beam limiter or no vision fault?

There appear to be two faults here. The initial small, pulsing picture could be due to failure of the width stabiliser circuit (Tr524 etc.), but check also for cracked ferrite cores and dry-joints associated with the large wound components in the thyristor line timebase. Beam limiting is carried out by Di528 etc., the control voltage entering the TBA970 chip at pin 8. To override the beam limiter action apply an externally-derived potential of 0·5-0·8V at this pin. If this makes no difference check for a 3·5V peak-to-peak vision signal at pin 15 of the i.f. module. If it's there, check the luminance delay line then the TBA970 chip. Otherwise suspect the TBA440 i.f. chip.

QUERY COUPON

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TELEVISION AUGUST 1989

AKAI VS5

The sound level fades up and down intermittently. It was first noticed on recordings but also occurs while viewing TV through the machine with no tape present.

A common cause of this problem is a faulty relay – RL401 on the audio board develops intermittent high contact resistance. If necessary check IC2 (M5144P) and the condition of VR2 on the tuner panel.

TEST CASE

320

Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

The most trouble-free sections of TV sets and VCRs, be they electrical or mechanical, are usually the least understood, perhaps because fault analysis and trouble-shooting are so rarely required. How many engineers are familiar with the intimate workings of digital servo circuits, teletext decoders and direct-drive motors for example? Not very many I suspect. The power supply and line output stage circuits in TV sets, the effect of loading-belt slippage and the symptoms of a worn or blocked video head are much more familiar matters!

It was this lack of familiarity with the operating principles of a normally reliable section of circuitry that caused a production hold-up recently on the VCR workbench. The machine being repaired was a Sanyo Model VHR3100, a conventional mid-range VHS machine a couple of years old. The main fault, no operation, was quickly enough traced to a faulty STK7226 stabiliser chip in the power supply.

When this chip had been replaced the machine was restored to working order in respect of the mechanics and the signal processing circuitry, but before wrapping up the job we decided to make a short test recording. Since none of the tuning selections produced anything on the screen other than noise the machine was put into the tuning mode – by keying CH PRESET. This broubht up an S (skip) indication on the fluorescent display, so the skip key was pressed, whereupon U and some bars were displayed. Key FINE TUNING UP then. The little bars winked a bit, then we had BBC-1 from the local relay transmitter on the screen. Pressing the memory key should then simultaneously lock the found channel in the memory and increment the channel display by one, ready for the next seek-and-find operation.

Not with this machine however! The channel display incremented, but the picture disappeared into a screenful of snow. We repeated the tuning process with the same results. Then, with a struggle, the user's operating instruction book was found and consulted. It's a pity that Sanyo don't, as many other manufacturers do, include the user instructions in the service manual. Anyway, the upshot of this was that the tuning process had been carried out correctly, so it seemed that a fault was present.

The search, memory and display processes are carried out on board TM-4, which contains two chips, a microcontroller and an M58659P EAROM memory, IC7402. Since the tuning sweep-and-find functions were working and a scope showed that serial data was passing from pin 2 of the microcontroller to pin 12 of the memory chip, it appeared that the fault lay in this device which seemed unable to store the data. Its 5V supply was found to be present and correct, and the presence of data on control lines C1, C2 and C3 was confirmed by using a logic probe.

There seemed little doubt that the memory chip was suffering from amnesia trouble. So a replacement was ordered and fitted. You guessed it: this produced no change in the symptoms. Further checks were then made. The memory button must have been working since it incremented the channel display. The clock signal left pin 7 of the microcontroller chip and entered pin 6 of the EAROM as it should. What else was there?

A known good TM-4 panel was pinched from another machine and fitted to the ailing one. The results were the same, proving that the fault was not on the suspect panel. Conversely the faulty machine's TM-4 panel worked in the other one. But the fluorescent display was much brighter. Seeing this the technician kicked himself and quickly went to the source of the trouble. What was it? See next month's issue for the answer.

ANSWER TO TEST CASE 319
– page 697 last month –

The advent of satellite TV has added to the skills and knowledge required of TV engineers – last month's puzzle was typical of the new ball-game! Sparklies indicate a low carrier-to-noise ratio, and the C/N ratio of the signal at the installation described last month was sporadically varying.

An important characteristic of all TV transmissions is the carrier wave polarisation. Incorrect receiving aerial (in this case the probe in the feedhorn assembly) polarisation causes a very sharp drop in received signal strength. With terrestrial transmissions the polarisation at a particular site is fixed, either vertical or horizontal. With satellite transmissions however the polarisation varies from channel to channel – in the case of Astra the channels have alternate horizontal and vertical polarisation.

To cater for this the feedhorn assembly contains a polariser. With the equipment specified the polariser is a magnetic type operated by d.c. supplied by the tuner. Some 35mA is fed via a separate pair of conductors, the supply polarity being programmed by the station selector system in the satellite tuner. So the fault could after all have been due to the tuner. Wind and rain would not have affected the indoor equipment however. In fact the fault was in the polariser's wire-junction link, made by the dish installer. The weather had got into the connections, which were poor to start with.

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